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ABSTRACT

The California Assessment Program (CAP) is meant to be an efficient testing program limited to furnishing program-diagnostic information to state-level policymakers. During 1981-82 all 3rd-, 6th-, and 12th-grade students in the state's public schools were tested in reading, written language, and mathematics basic skills. Summary findings were that grades 3 and 6 test scores improved. Grade 12 scores improved in written language and spelling and decreased slightly in reading and mathematics. Elementary grade scores are reported in scaled units from 100 to 400, with a statewide average of 250 in base-year 1980. Grade 12 scores continue to represent the percentage of test questions answered correctly. Test results are comparable on a common scale to those of previous years; they show how the performance of California students compares with national scores. Scholastic Aptitude Test scores for college-bound seniors; third grade students' attitudes toward the basic skills; the issue of time for learning in different learning areas in elementary and secondary schools; and the availability and use of computers in state elementary schools are examined. An appendix lists the assessment advisory committees. (CM)

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Student Achievement in California Schools

1981-82 Annual Report

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California Assessment Program

CALIFORNIA STATE DEPARTMENT OF EDUCATION Wilson Riles, Superintendent of Public Instruction Sacramento, 1982

California Assessment Program

Student Achievement in California Schools

1981-82 Annual Report

Prepared Under the Direction of
Alexander I. Law, Chief
Office of Program Evaluation and Research

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I. Summary of Findings

- Grade 3 test scores improved in 1981-82 for the 15th consecutive year.
- Grade 6 scores improved for the 5th year.
- Grade 12 scores improved in two content areas and decreased slightly in two.

During the 1981-82 school year, all third, sixth, and twelfth grade students in California public schools were tested in the basic skills of reading, written language, and mathematics. The following paragraphs provide a brief summary of the main findings.

Grade Three Results

Reading test scores for third grade pupils have been improving steadily since statewide testing in that grade began in 1967. This trend has continued through 1981-82. A summary of the test results is presented in Table 1. The overall gain in 1981-82 was four scaled score points.

The areas of written language and mathematics have only been tested for three years in grade three. The scores this year were up by five points in language and seven points in math.

Special equating studies were conducted to determine the relationship of the current performance of California pupils to the performance of a sample of students across the nation. The median score of third grade pupils in California was determined to be at the 60th percentile rank in reading, the 56th in written language, and the 55th percentile rank in mathematics.

Grade Six Results

All students in grade six took the Survey of Basic Skills: Grade 6, another test developed specifically for the California Assessment Program. The scores of California sixth grade students improved in all content areas tested: reading, written language, and mathematics (see Table 1). The amount of gain was least in reading (two points), next most in language (four), and most in mathematics (five).

Summary of Findings

Table 1

Numbers of Students Tested and Average Test Score by Grade Level and Content Area from 1979-80 Through 1981-82 California Assessment Program

Grade level and content area (number tested)	Average test score			Difference	
	1979-80	1980-81	1981-82	1979-80 to 1980-81	1980-81 to 1981-82
Grade 3 (254,232)					
Reading	250	254	258	+4	+4
Written Language	250	255	260	+5	+5
Mathematics	250	254	261	+4	+7
Grade 6 (293,281)					
Reading	250	252	254	+2	+2
Written Language	250	253	257	+3	+4
Mathematics	250	253	258	+3	+5
Grade 12 (220,603)					
Reading	63.1	63.4	63.2	+0.3	-0.2
Written Language	62.4	63.1	63.2	+0.7	+0.1
Spelling	68.8	69.0	69.5	+0.2	+0.5
Mathematics	66.8	68.0	67.7	+1.2	-0.3

Note: The scores for grade three and grade six are reported in scaled score units. These scores, briefly described in Chapter II, range from 100 to 400 with a statewide average of 250 in 1980, the base year. The scores for grade twelve continue to represent the percentage of questions answered correctly. National comparisons for all scores are available in Chapter VI.

An equating study provided a basis for comparing sixth grade California students with a national sample of students tested in 1973. On the basis of the results of the study, the median sixth grade student in California is above the national median in all areas. In reading the median sixth grader in California moved from the 57th to the 58th percentile rank in 1981-82. The median student moved from the 55th to the 57th percentile rank in written language and increased to the 58th in mathematics.

Grade Twelve Results

All students in grade twelve took the same test that has been administered since 1975-76--the Survey of Basic Skills: Grade 12. For the first time, scores in 1980-81 were up in all content areas. In 1981-82, the scores went up in two areas and down in two areas. Reading slipped by 0.2 percent correct, and math scores went down by 0.3 percent correct. Written language and spelling improved by 0.1 and 0.5 percent correct, respectively.

Summary of Findings

Special equating studies provide a basis for comparing the performance of California twelfth graders with that of national test publishers' norm samples tested in 1962 and 1970. On the basis of the 1962 norms, the median twelfth grade student in California remained in 1981-82 at the 42nd percentile rank in reading, the 35th percentile rank in written expression, and the 46th percentile rank in mathematics.

Comparisons with two other tests with 1970 norms placed California twelfth grade students somewhat lower: at the 32nd and 35th percentiles in reading, at the 29th and 30th percentiles in written expression, and at the 44th and 47th percentiles in mathematics.

On the basis of more recent norms (1978) for these tests, California's performance has generally improved relative to the nation. The median California student is now in the forties (percentile rank) on most of the tests, and above the 50th percentile on two of the comparisons.

Other Findings

Chapter VII presents a comparative analysis of the amount of instructional time California students receive, relative to several national estimates. The main differences are in the areas of mathematics and science (less for California students) and are especially strong for college-bound students.

Chapter VIII presents the results of a survey of the availability and use of computers in California elementary schools.

II. Introduction to the Report

This report contains the complete statewide results of the California Assessment Program, including some features that have become standard and some that are new this year:

- Detailed findings. Information is presented not only for the major content areas of reading, written language, and mathematics but also for a variety of specific skill areas within each major area.

- National comparisons. Although the tests were developed to correspond specifically to the skills and concepts being taught in California schools, special studies have been conducted to show how the performance of California students compares to that of samples of students from throughout the nation.

- Expert opinions. Recognized authorities in each professional field have presented their interpretation of the results for each of the content areas by identifying skill areas of relatively impressive student performance and other skill areas that need attention.

- Comparable results. All test results in this report are comparable to those of previous years, either because the tests have not been changed or where new tests have been introduced the results from the old and new tests have been placed on a common scale.

- School attitudes. For several years the statewide advisory committees responsible for developing the CAP tests have encouraged the measurement of attitudes toward school subjects as well as actual ability to perform the skills. The report now includes information about third grade students' attitudes toward reading, written language, and mathematics.

- Scholastic Aptitude Test (SAT) scores. Although the Scholastic Aptitude Test is not a part of the California Assessment Program, the latest results for California's college-bound seniors and their counterparts throughout the nation are included in this report so they can be compared conveniently to the basic skill test results for all California public high school seniors.

- School Characteristics. The California Assessment Program is mandated to provide information about the characteristics of effective schools and the factors related to the quality of their programs. This year's report focuses on the issue of time for learning, specifically, how elementary schools allocate the available time to different learning areas, and the number of courses California high school seniors have completed in different subject areas. It also presents information on the availability and use of computers in California elementary schools.

Introduction to the Report

Development of the California Assessment Program

The California Assessment Program was first fully implemented in 1974-75. In design, development, and procedures, it is unique in the nation. The assessment program was designed with several criteria in mind: (1) it must be relevant to California schools; (2) it must cover the full range of instructional objectives; (3) it must provide program-diagnostic information at local and state levels; and (4) it must take only a minimum of testing time. This section describes the process of developing such a program.

Background and Assumptions

The state assessment program had its foundation in two legislative acts: (1) the California School Testing Act of 1969, a revision of a 1961 law which first required an achievement testing program in the public schools; and (2) the Miller-Unruh Basic Reading Act, which originally required reading tests in grades one, two, and three. The testing program was revised by 1972 legislation, and major changes were made in the program as a result of that legislation.

The changes in the statewide testing program were based on the principle that an efficient state testing program has to be limited in scope--that is, limited primarily to the task of furnishing useful information to state-level policymakers and decision makers. It was assumed that the program could not meet all of the many information needs of local school district personnel and that assessment information needed at the classroom level could best be collected by local school personnel.

In spite of this assumption, the program was designed to report as much information as possible to local personnel. Since all students at a grade level in all schools were tested, it was possible to provide very detailed analytical reports for each school to supplement locally obtained information. In fact, the results of a survey of all districts in California showed that most districts have found this unique information very useful in evaluating and revising programs. Board members and other local citizens have relied heavily upon statewide results in making judgments about local needs and accomplishments, primarily because of the uniform and comparable nature of the information provided.

Reasons for Revising the Testing Program

Two major problems were addressed through the revision of the statewide testing program:

- Test relevancy and breadth: The incomplete match between the relatively narrow range of skills measured by any one published standardized test, on the one hand, and the variety of instructional programs in California schools, on the other, made it difficult to assess the skills of California students or the effectiveness of the programs with any degree of assurance of fairness. Furthermore, it was not possible to assess the relative strengths and weaknesses of California students in order to have an indication of how instructional programs should be redirected, since the standardized tests being used yielded only total scores.

- Testing time. Previous testing instruments required an inordinate amount of student time for the testing process--inordinate, at least, in relation to the usefulness of the results. The use of a new testing technique called matrix sampling has now reduced the amount of testing time at certain grade levels from as much as three and one-half hours to 30 minutes. Under this sampling method, all students at a grade level in all schools are tested, but each student takes only a portion of the total test. Results for an individual student cannot be obtained, but quite accurate estimates of the overall performance of groups of students can be computed.

The National Norm Dilemma

Since 1962, the first year of statewide testing in California, all tests adopted for use had been commercially published instruments with "national" norms. The new tests described in this report were constructed specifically for use in California schools. The decision to develop tests rather than use commercial "off-the-shelf" tests with national norms was not made casually. Comparisons to national averages are not only interesting but are also useful as a basis for judging the overall relative effectiveness of California's instructional programs. Furthermore, California law (Education Code sections 60663 and 60640) requires that such information be made available.

A real dilemma, one with both philosophical and technical aspects, faces anyone who would measure the basic skills of California students: to choose a test which has national norms but fails to address all the skills taught in California schools, or to develop a relevant test which does not allow easy and immediate national comparisons. Assessment programs in other states are about equally divided between these two approaches. After 11 years of using tests with national norms but less than satisfactory coverage of the skills being taught in California schools and after observing the difficulties faced by other states in interpreting the results from their own tests without national norms, the course to be followed was obvious: Develop a test which fits the instructional programs of most California schools and then find a way to compare those results to national norms.

A plan which could accomplish this (allow one to have one's cake and eat it, too) had to overcome two main problems with the national norms associated with published standardized tests:

1. No single test is given to all students in the country. Of necessity, a publisher's norm is, therefore, only an estimate of what the distribution of scores would be like if, in fact, the test had been taken by all students in the United States. For this reason, norms vary from publisher to publisher, sometimes in the extreme. In California's own recent history, the Stanford Reading Test was administered to all second grade students in the 1969-70 school year, and the median California student scored at the 38th percentile of that publisher's norms. In the following year, the Cooperative Primary Reading Test was administered to all second grade

students. The median California students scored at the 50th percentile of that publisher's norms. The different result was clearly a reflection more of the difference in norms than of the difference in reading achievement.

2. A second problem with norms is that they are not updated very often. For instance, the Cooperative Primary Reading Test was normed during the 1965-66 school year. As a result, when those norms are referred to, it must be clearly understood that the comparisons being made are to the publisher's estimate of what scores on that test would have been if administered to all students in the country at that time. If reading scores for the nation had dropped continuously since 1965-66, an "average" score for California students might, in fact, reflect achievement far above current nationwide averages.

The resulting plan is straightforward and efficient. It involves the equating of the California tests to standardized tests with national norms and updating those comparisons as new norms or new tests become available. The equating process requires that a sample of students take both the California test and one of the other tests. The effect of the statistical analyses following the testing is to show how California students would have scored if they had all taken the standardized test. Following recent refinements to the equating procedures, a study now has to be conducted only once, but the annual progress on the California test can be translated into the appropriate national percentile ranks--against the year in which the publisher's test was normed, of course, not against the national performance for that year. The latter would be the most useful information, but it is simply not obtainable.

This solution has several advantages: (1) the national comparisons are more timely since they can be updated as new norms become available; (2) the estimates are more stable since they do not depend on the representativeness of a single publisher's sample; and (3) it allows California schools to be assessed with a test which fits the objectives of the instructional program and simultaneously, with almost no additional testing, allows that performance to be compared to national norms.

Essential Information About the Numbers Used in This Report

The Percent Correct Score

A statistic used in this report to indicate the achievement levels of California students is the "average percent correct score." For a given set of test questions, this number is the percentage of correct test responses, with one response being equal to the answer of one student to one question, and the total number of responses being equal to the number of students multiplied by the number of items on the test. For example, if three students took a test with ten questions and if each of the three answered five of the ten questions correctly, the total number of responses would be 30, the total number correct would be 15, and the average percent correct score would be 50. It can also be said that the average student answered 50 percent of the questions correctly; or that, on the average, 50 percent of the questions were answered correctly.

The average percent correct score and the simultaneous presentation of illustrative test questions or exercises are designed to add to the clarity and usefulness of the findings. It should be easier, as a result, to see what California students are able to do. Unfortunately, this method is so new in educational evaluation and assessment that guidelines and rule-of-thumb benchmarks are not available. Each reader will have to evaluate the adequacy of the results. The emphasis is on establishing realistic and necessary levels of actual competence rather than on the traditional comparing of results to a national norm.

How High Is High?

It will be noted that most of the average percent correct scores hover around the 60s and 70s; however, some are down in the 30s, and some are up in the 90s. Two points must be kept in mind in interpreting these figures:

1. The major reason that the average scores are in the 60s and 70s, rather than the 90s, is that the aims of the instructional programs at each level in California schools go beyond the basic, minimal levels of performance expected of all students. In reading, for example, those skills which are mastered by most students by the end of the third grade are not even tested in the sixth grade. Testing time is too valuable and the scoring and processing too expensive to justify gathering information which does not add to what is already known about California students.

2. It should be obvious that high scores in particular skill areas do not necessarily indicate effective programs; or low scores, the opposite. Some tasks are inherently more difficult. In reading, for example, it is not considered outstanding that by the end of grade three, nearly all students can immediately recognize and read certain short words; and it is not at all disappointing that only about 67 percent can answer certain questions requiring a student to recognize cause-and-effect relationships among sentences.

Development of a New Reporting System

The Need. For many years the results of the California Assesment Program have been reported in this volume in terms of the percent of questions answered correctly. School district personnel have also received their local results in this form. Local results, of course, can also be compared to the scores of other schools and districts, using the percentile rank tables prepared annually.

Although the percent correct score has the advantages described in the preceding section and will continue to be the basis for most of the interpretations and recommendations proposed in this report, they have certain disadvantages, some of which are outlined below:

1. When a new test is introduced, as in grade three in 1979-80, the scores from the new test cannot be compared directly to those of the old test. The new test in grade three, for example, is more difficult than the old test. A simple comparison of the scores would make it appear as if all schools had declined, when in reality the average score for 1980 went

up slightly. The relationship of the scores on both tests must be determined through an "equating" study. The progress of a school or district can then be followed when the scores for both tests are put on a common scale.

2. The percent correct scores do not easily facilitate comparisons across content areas (e.g., reading with math) or across grade levels. This is not really a problem at the state level, since the focus is primarily on the actual performance of students; i.e., the proportion of them who can answer given types of questions correctly. School personnel, however, often wish to compare the relative performance of their students in different content areas, for example, reading performance with math performance. It can be seen that the rationale for and process of developing the tests militates against this simple comparison.

   The California Assessment Program tests were expressly designed to measure the wide array of skills taught in a good instructional program rather than to make an easy test by focusing on simple skills or an extremely difficult test by covering only the complex or advanced skills. Statewide advisory committees designated the proportion of the test to be devoted to the various skill areas on the basis of their importance, rather than their relative easiness or difficulty. Therefore, there is no reason to expect a 70 percent correct score in reading to be equal to a 70 percent score in math, or a 65 percent correct on the third grade math test to equal a 65 percent correct on the sixth grade math test.

The Solution. After three years of developmental effort, the Department of Education has implemented a scaled score system for reporting the results of the California Assessment Program tests. It was introduced first in 1980 at the third grade level in conjunction with the new Survey of Basic Skills: Grade 3 and in 1982 at grade six. The power of this new scaled score methodology is best realized with a test that is specifically designed to capitalize on its strengths.

The new scaled scores range from approximately 100 to 400. However, relatively few of the district-level scores go below 150 or over 350. This particular range of numbers was selected to avoid decimals, negative numbers, and confusion with percent correct scores and percentile ranks. Otherwise, the scale is quite arbitrary; any particular score--for example, a score of 320--has no obvious meaning that would allow an immediate judgment about a school program. Scores do not indicate the percent of questions answered correctly or the percentage of schools which score higher or lower--although both of these pieces of information can be obtained from tables which are provided to all school districts. In fact, it is this detached, objective quality which makes these scores most valuable. They are not tied to any particular test in any particular year. They are designed to be a baseline measure which can reflect the progress of a school or a school district (or the state) over a period of years--irrespective of changes to the test or the progress of other schools or districts. Unlike percentile ranks, which are calculated annually, this scale has the same meaning in terms of relative achievement each year. A school or district can monitor its progress without being affected by the achievement of other schools or districts.

Introduction to the Report

The achievement for the average (mean) third grade student and sixth grade student in California has been set to a scaled score of 250 for 1979-80. Bearing some similarity to the more familiar Consumer Price Index, the score of 250, although arbitrary, becomes a useful point of reference for monitoring change.

Since the scores for the content areas of reading, language, and mathematics are all on the same scale, it is possible to compare the performance of a school in reading to its performance in math without making any translation into normative scores, such as percentile ranks.

Furthermore, in comparison to other scores, the units on the scale (100 to 400) represent more nearly equal intervals. The differences between different percentile rank points, for example, are particularly uneven; the distance between a school at the 50th percentile and one at the 55th percentile is very small in comparison to the distance between a school at the 90th percentile and one at the 95th. These uneven intervals make it very difficult to compare the progress of a school at the 50th percentile with that of one at the 90th. Such comparisons are greatly facilitated by scaled scores.

In summary, the scaled scores now in use in grades three and six have the following characteristics and features:

- Scaled scores range from approximately 100 to 400, with the statewide average student achievement in 1980 set at 250.
- Scores can be compared over years, independent of test changes or amount of statewide progress.
- Scores can be compared among content areas.
- More equal intervals between scaled scores allow better assessment of the progress of high or low scoring schools and school districts.
- Scores can be compared directly across grade levels.

III. Reading Achievement for Grades Three, Six, and Twelve

Synopsis of Findings

- Grade three reading scores improved for the fifteenth consecutive year; gains were shown in all 27 skill areas.

- A new sixth grade test was administered for the first time in 1981-82. Results from an equating study show that gains in sixth grade reading were registered for the fifth consecutive year.

- Twelfth grade reading scores declined slightly (0.2 percent correct) from 1980-81 to 1981-82, continuing a generally downward trend at this level since 1975-76.

- The median twelfth grade student in California is now scoring at the 42nd percentile on national norms in reading, while the median sixth grader is at the 58th percentile, and the median third grader is at the 60th percentile (see Chapter VI, "Comparisons with National Norms").

Committee Recommendations

After reviewing the data presented in the three following sections, the Reading Assessment Advisory Committee* offered the following recommendations:

1. Parents should help their children discover the enjoyment of reading by:
    - Reading aloud to them
    - Encouraging pleasure reading in the home
    - Using television to stimulate reading and discussing the content of both.

2. Teachers should help their students discover the enjoyment of reading by:
    - Reading aloud to them at all grade levels to "immerse" them in the sound of spoken literature
    - Setting aside class time for sustained silent reading, during which all teachers, acting as role models, read silently along with the students

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* The names of the advisory committee members are listed in Appendix A.

3. Teachers at all levels should strive to foster vocabulary development and higher level thinking skills in all content areas across the curriculum. In so doing, teachers should:
    - Have actual dialogue with students and provide multiple opportunities for writing instead of overreliance on assigning and correcting workbooks and worksheets. (Research shows that students learn more and retain it longer when such active strategies are employed)
    - Provide opportunities for oral language practice through discussions, reports, and question-and-answer sessions that foster students' thinking
    - Require that students explain and support their responses in order to explore and expand the thinking strategies students are using
4. Often, the school principal greatly influences the success or failure of instructional programs. Every school principal should provide strong instructional leadership and staff development activities by:
    - Stimulating the teaching of comprehension, thinking, and writing skills in all disciplines across the curriculum
    - Encouraging teachers and parents to pursue the activities suggested in recommendations 1, 2, and 3 above
    - Annually sharing CAP results and resources with all teachers and leading them in a thoughtful review of curriculum
5. District program leaders should:
    - Set objectives and use materials that are likely to stimulate the highest levels of creative thinking through involvement of students in application, analysis, synthesis, and evaluation
    - Seek ways to stimulate more effective teaching and learning in the content areas at the secondary level (such as identifying strong teaching models at the school site)
6. The Department of Education and State Board of Education should consider changing the current twelfth grade assessment to an earlier level, such as the end of the eleventh grade, to lessen problems of student motivation and to allow time for corrective action if there are skill deficits.

Reading Results, Grade Three

Test Scope and Foundations

The reading section of the Survey of Basic Skills: Grade 3 contains 270 questions covering five broad skill areas: (1) word identification; (2) vocabulary; (3) literal comprehension; (4) inferential comprehension; and (5) study-locational skills. These skill areas reflect the emphases in the Reading Framework for California Public Schools: Kindergarten Through Grade Twelve, (Sacramento: California State Department of Education, 1980), the county superintendents' courses of study, and state-adopted reading textbooks commonly used at the third grade level.

Decisions about the relative emphasis and breadth of content for each of these skill areas were made by the Reading Assessment Advisory Committee, a group of reading specialists representing a cross section of geographical regions, institutions, instructional levels, and professional groups throughout California (listed in Appendix A). In making these decisions, the committee members considered information from broad field reviews of preliminary test content specifications. The results indicated the degree of emphasis placed on each skill area and whether or not the skill should be assessed on the Survey. These field reviews reflected district, school, and teacher points of view.

After careful consideration of the reading framework and field review information, the reading committee decided that the area of comprehension should receive the greatest emphasis on the reading section of the Survey. This decision was also consistent with the state-adopted Handbook for Planning an Effective Reading Program (Sacramento: California State Department of Education, 1979), which includes the following statement: "Comprehension is the central goal of reading" (page 7). Thus, most of the reading questions are literal or inferential comprehension items, and, of course, the vocabulary items involve comprehension as well. All the reading questions, except the study-locational items, are based on reading selections so that pupils are never asked to deal with reading skills apart from the context of a passage.

The relative degree of emphasis assigned to each of the reading skill areas in the Survey is presented graphically in Figure 1. For an illustrated description of all reading skill areas and underlying rationale, see Survey of Basic Skills: Grade 3, Rationale and Content (Sacramento: California State Department of Education, 1980).

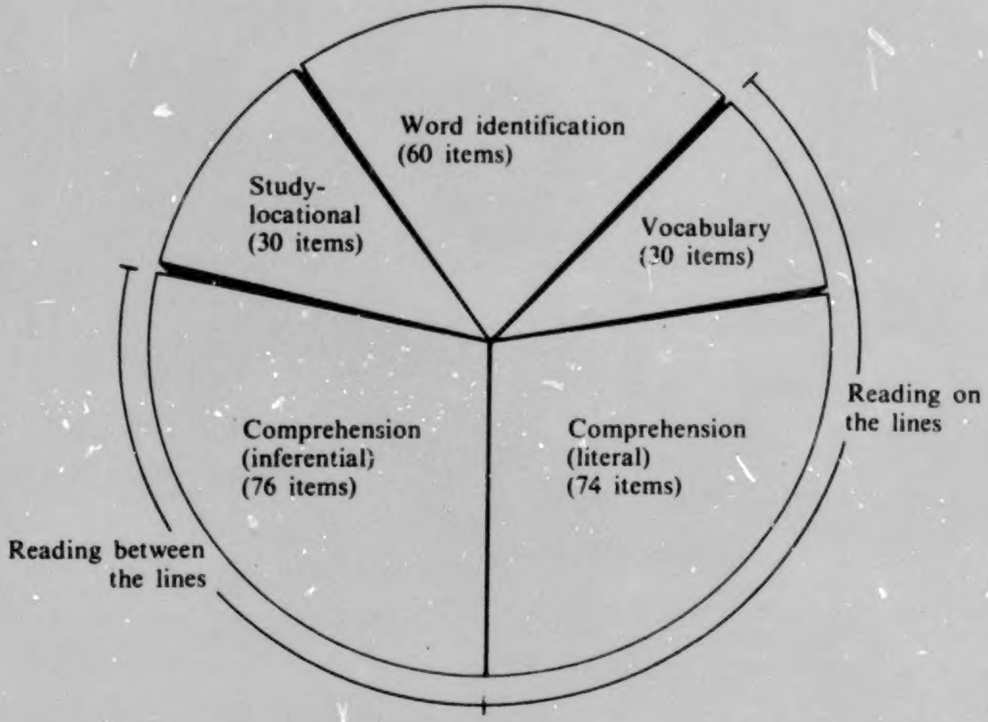


Fig. 1. Number of questions, by skill area, in the reading portion of the *Survey of Basic Skills: Grade 3*

Reading Results for Grade Three

The Survey of Basic Skills: Grade 3 was administered for the third successive year in 1981-82. The results of third grade performance on the reading section of this test are shown in Table 2. Year-to-year changes in overall performance and in skill area performance are also shown in the table and illustrated graphically (major skill areas only) in Figure 2.

Reading Results, Grade Three

Table 2

Reading Scores of California Third-Grade Students and Change in Mean Scores on the Survey of Basic Skills: Grade 3, 1979-80 Through 1981-82

Skill Area	Number of questions	Mean score, by year 1979-80	1980-81	1981-82	Change 1979-80 to 1980-81	1980-81 to 1981-82	Total Gains 1979-80 to 1981-82
READING TOTAL	270	70.0	70.6	71.5	+0.6	+0.9	+1.5
Word identification	60	76.5	77.3	78.2	+0.8	+0.9	+1.7
Phonics	30	78.9	79.6	80.3	+0.7	+0.7	+1.4
Vowels	15	77.7	78.4	79.0	+0.7	+0.6	+1.3
Consonants	15	80.1	80.8	81.6	+0.7	+0.8	+1.5
Structural analysis	30	74.2	75.0	76.2	+0.8	+1.2	+2.0
Prefixes, suffixes, roots	18	69.0	69.7	71.0	+0.7	+1.3	+2.0
Contractions and compounds	12	82.1	82.8	84.0	+0.7	+1.2	+1.9
Vocabulary	30	62.5	62.8	64.0	+0.3	+1.2	+1.5
Recognizing word meanings	16	68.5	68.8	70.1	+0.3	+1.3	+1.6
Using context with multiple-meaning words	14	55.7	55.9	57.1	+0.2	+1.2	+1.4
Comprehension	150	65.8	66.2	67.0	+0.4	+0.8	+1.2
Literal	74	65.2	65.7	66.4	+0.5	+0.7	+1.2
Details	37	63.5	64.0	64.6	+0.5	+0.6	+1.1
—from single sentence	20	63.7	64.1	64.9	+0.4	+0.8	+1.2
—from two or three sentences	17	63.3	63.9	64.3	+0.6	+0.4	+1.0
Pronoun references	18	70.9	71.1	72.0	+0.2	+0.9	+1.1
Sequence	19	63.2	63.9	64.6	+0.7	+0.7	+1.4
Inferential	76	66.3	66.8	67.5	+0.5	+0.7	+1.2
Main idea	19	69.5	70.1	71.3	+0.6	+1.2	+1.8
Cause and effect	20	66.8	67.1	67.9	+0.3	+0.8	+1.1
Drawing conclusions	37	64.3	64.9	65.4	+0.6	+0.5	+1.1
—about characters	15	70.5	71.0	72.1	+0.5	+1.1	+1.6
—from details	12	56.5	56.9	57.0	+0.4	+0.1	+0.5
—from overall meaning	10	64.4	65.2	65.4	+0.8	+0.2	+1.0
Study-locational	30	85.9	86.7	87.8	+0.8	+1.1	+1.9
Alphabetizing	15	82.2	83.1	84.0	+0.9	+0.9	+1.8
Table of contents	15	89.5	90.3	91.6	+0.8	+1.3	+2.1

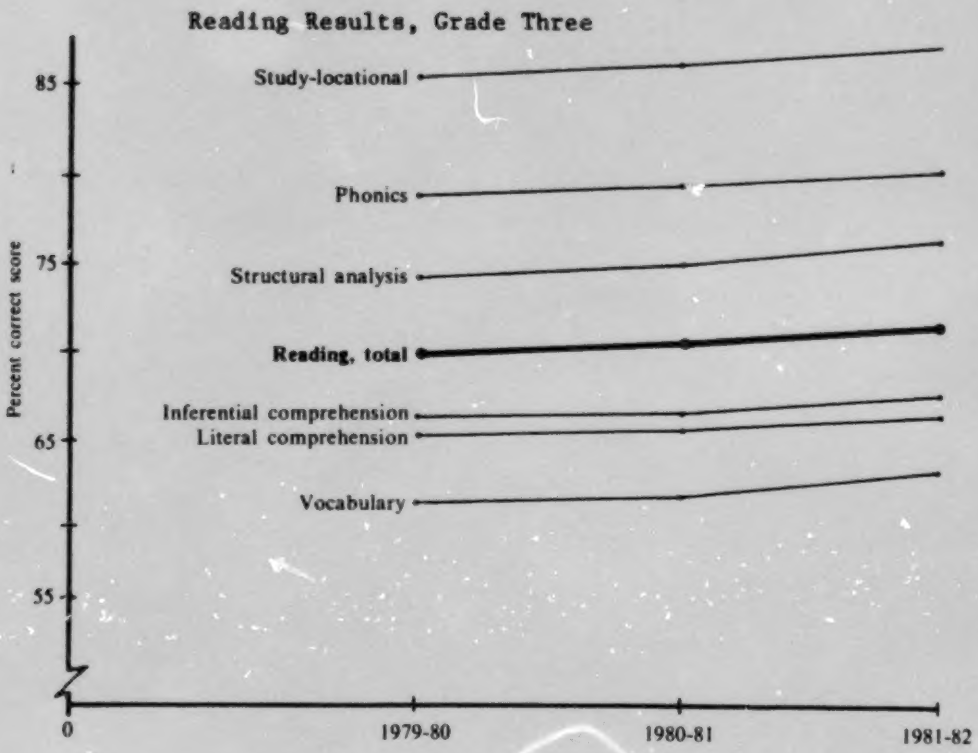


Fig. 2. Percent correct scores of California third grade students for the major skill areas in reading, 1979-80 through 1981-82

The following observations are evident from the data in Table 2:

- The total reading score for California's third grade students improved by 0.9 percent correct from the spring of 1981 to the spring of 1982, yielding an overall gain of 1.5 percent correct from the spring of 1980, when the test was first administered.

- The largest gains in percent correct from 1981 to 1982 were registered for the following skills:

Structural analysis	+1.2
Prefixes, suffixes, roots	+1.3
Contractions and compound words	+1.2
Vocabulary	+1.2
Recognizing word meanings	+1.3
Using context with multiple-meaning words	+1.2
Main ideas	+1.2
Drawing conclusions about characters	+1.1
Table of contents	+1.3

- The smallest gains in percent correct from 1981 to 1982 were registered for the two following skills:

Drawing conclusions from details	+0.1
Drawing conclusions from overall meaning	+0.2

- The largest gains in percent correct over the two-year period from 1980 to 1982 were registered for the following skill areas and skills:

Structural analysis	+2.0
Prefixes, suffixes, roots	+2.0
Table of contents	+2.1

- The smallest gain in percent correct from 1980 to 1982 was registered for drawing conclusions from details (+0.5 percent correct).
- Of the major reading skills tested, the study-locational skill area was the easiest cluster of items (87.8 percent correct), followed by phonics (80.3 percent correct), and structural analysis (76.2 percent correct). Vocabulary (64.0), literal comprehension (66.4), and inferential comprehension (67.5) were the most difficult broad skill areas for third graders.
- At the subskill level, the easiest area was the cluster of questions pertaining to using a table of contents (91.6), while drawing conclusions from details (57.0) was most difficult for third graders (replacing vocabulary-using context as the most difficult area for third graders on the reading portion of the Survey).

Interpretation of Skill Area Results, Grade Three

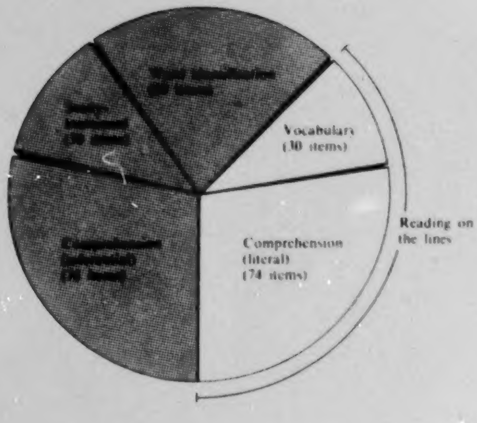
The members of the Reading Assessment Advisory Committee, a panel of distinguished California educators with recognized expertise in reading instruction and assessment, analyzed, interpreted, and evaluated the 1981-82 reading results for grade three. In this process, they examined the changes in skill area performance in light of the philosophy underlying the CAP reading tests. This philosophy is stated generally in the Reading Framework for California Public Schools and more specifically in Survey of Basic Skills: Grade 3, Rationale and Content.

Because the broad area of comprehension is judged by the committee members to be the skill area of greatest educational and social significance, the following discussion focuses upon the two levels of comprehension assessed on the Survey of Basic Skills: Grade 3 and identified in the Reading Framework for California Public Schools: (1) "Reading on the lines;" and (2) "Reading between the lines."

Reading on the lines ...

"Reading on the lines" refers to the most basic level of comprehension and involves questions that require students to respond to information explicitly stated in the text. These skills, as they are assessed on the Survey of Basic Skills: Grade 3, are briefly described and illustrated below.

Reading Results, Grade Three



- **Vocabulary** items assess the ability to identify synonyms, antonyms, and definitions of words used in a reading passage, and the ability to use the context of the passage to identify the meaning of a multiple meaning word (for example, "saw," "run," and "bark").
- **Literal comprehension** items assess the ability to answer literal questions including sequence, details (explicitly derived from one, two, or three sentences in the reading passage), and pronoun references (Jack is a boy. He is a good reader. ....Question: Who is a good reader? Answer: Jack).

Illustrative items

The time is midnight. The full moon is high in the sky. Here and there a bonfire lights the beach. People are gathered around the fires, waiting. Suddenly, the beach is alive with thousands of wiggling fish as wave after wave carries them to shore. At once the people are splashing through the waves, snatching up the fish.

Does it sound like a wild story? It is not just a story. It is a grunion run, and it happens several times every year in southern California.

The grunion is a small, silvery fish that is between five and six inches long. The season for laying eggs is from the middle of February to early September. During those months, on the nights of the highest tide, the grunion swim to shore to lay their eggs in the sand. The next high tide uncovers the eggs. The baby grunion burst out like popcorn and ride the waves to sea.

The opposite of high is

o small.
o alive.
o low.
o tall.

Where were the people waiting?

o in a boat
o near a house
o under a tent
o on the beach

Reading Results, Grade Three

The scores for vocabulary and literal comprehension are shown in Figure 3 with percent correct scores for 1981-82 and their cumulative percent correct gains from 1980-81 to 1981-82.

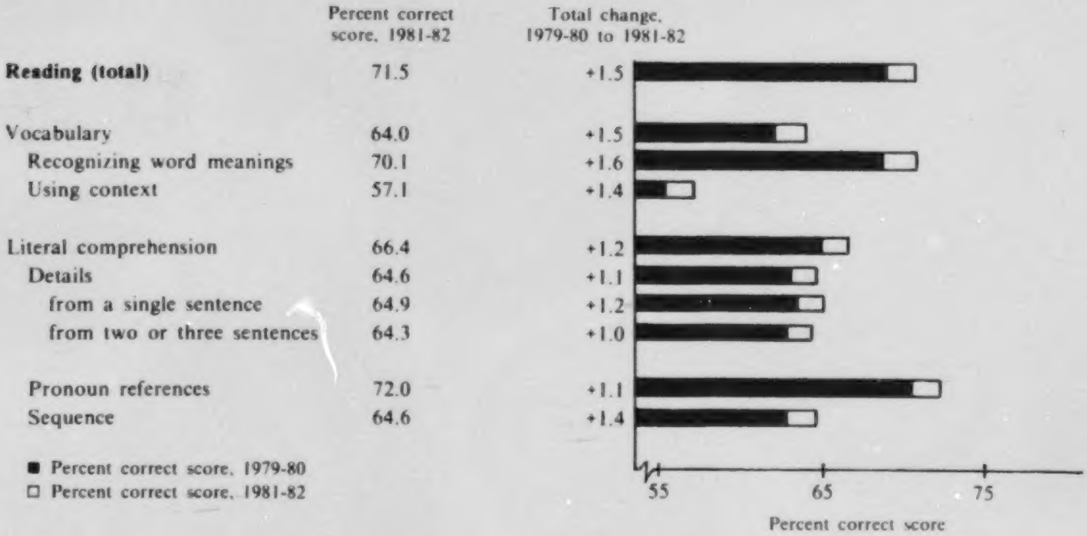


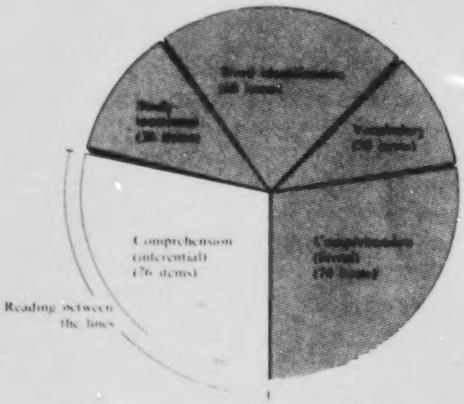
Fig. 3. Percent correct scores and cumulative gains of California third grade students for the reading skill areas of vocabulary and literal comprehension

The members of the Reading Assessment Advisory Committee were extremely pleased with the consistent gains shown on all vocabulary and literal comprehension skills. They particularly noted the substantial increases in vocabulary, which had shown only very slight gains the previous year (see Table 2). The committee members observed that the use of context in defining multiple-meaning words continues to present considerable difficulty to third graders; however, this skill, which, was the most difficult area on the third grade reading test in previous years, is presently the second most difficult skill area. The same kind of context questions appear on the Survey of Basic Skills: Grade 6, yet sixth graders apparently handle them with ease, since percent correct scores are quite high at that level. It is reasonable to conclude that subsequent instruction, experience, and/or maturation during grades four, five, and six serve to overcome students' apparent weakness in using context in grade three.

While the members of the committee were pleased to see progress in third grade students' ability to use context, they concluded that more instructional emphasis is needed in the overall area of vocabulary, given the central role that knowledge of word meanings plays in comprehension.

Reading between the lines...

"Reading between the lines" refers to the higher-level thinking skills that are employed when comprehension extends beyond the literal message of the written material. Students must respond with ideas or opinions that are based on the material read, but that are not stated explicitly in the material. These skills, as they are assessed on the Survey of Basic Skills: Grade 3, are briefly described and illustrated below.



- Inferential comprehension items assess the ability to identify the main idea of a story, infer a cause-and-effect relationship, and draw conclusions from details, from overall meaning, and about characters.

Illustrative item

The time is midnight. The full moon is high in the sky. Here and there a bonfire lights the beach. People are gathered around the fires, waiting. Suddenly, the beach is alive with thousands of wiggling fish as wave after wave carries them to shore. At once the people are splashing through the waves, snatching up the fish.

Does it sound like a wild story? It is not just a story. It is a grunion run, and it happens several times every year in southern California.

The grunion is a small, silvery fish that is between five and six inches long. The season for laying eggs is from the middle of February to early September. During those months, on the nights of the highest tide, the grunion swim to shore to lay their eggs in the sand. The next high tide uncovers the eggs. The baby grunion burst out like popcorn and ride the waves to sea.

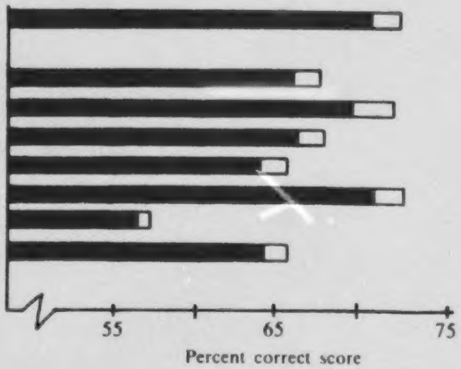
You can tell from the story that baby grunion probably

- ○ will die in very deep water.
- ○ need to be taught to swim.
- ○ will lay five or six eggs.
- ○ can stay alive in deep water.

Reading Results, Grade Three

The scores for inferential comprehension are shown in Figure 4 below with percent correct scores for 1981-82 and cumulative percent correct gains from 1979-80 to 1981-82.

	Percent correct score, 1981-82	Total change, 1979-80 to 1981-82
Reading (total)	71.5	+1.5
Inferential comprehension	67.5	+1.2
Main idea	71.3	+1.8
Cause and effect	67.9	+1.1
Drawing conclusions	65.4	+1.1
about characters	72.1	+1.6
from details	57.0	+ .5
from overall meaning	65.4	+1.0



■ Percent correct score, 1979-80
□ Percent correct score, 1981-82

Fig. 4. Percent correct scores and cumulative gains of California third grade students for the reading skill area of inferential comprehension

The members of the Reading Assessment Advisory Committee applauded the schools for the consistent increases shown in the skill areas of inferential comprehension, which require students, in effect, to read "between the lines." Research has shown that such reading/thinking skills can be taught if teachers choose to address them and know how to phrase questions that require students to think and imagine. The committee members noted that main ideas and drawing conclusions about characters are the two skill areas that have registered the largest total increases over the past two years. This may reflect the current emphasis in reading instruction in the primary grades. The reading skill area showing the least positive gain was drawing conclusions from details, which has shown up as a consistent weakness at all grade levels in previous years. The difficulty in this area is not surprising since such questions involve multiple-step processes, including reading carefully for details and drawing a conclusion from the appropriate detail. The members of the committee recommended still more emphasis on higher-level thinking skills--main idea, cause and effect, drawing conclusions from details, and other inferential comprehension skills--especially in view of the still higher gains registered in the easier, more basic skills such as structural analysis.

The members of the Reading Assessment Advisory Committee concluded their analysis of grade three test results by offering four instructional recommendations, which are presented below.

READING ASSESSMENT ADVISORY COMMITTEE'S INSTRUCTIONAL RECOMMENDATIONS FOR GRADE 3

1. Research shows that students learn more and retain it longer when they have actual dialogue with the teacher and have multiple opportunities to write. Such active teaching strategies should be employed much more heavily and frequently than assigning and correcting worksheets and workbooks.
2. Comprehension, especially the higher-level thinking skills, and not the mechanics of word identification should be emphasized in the primary grades.
3. Every classroom should include numerous opportunities for oral language practice through discussions, reporting, and question-and-answer sessions.
4. Teachers should explore the reasons that students make mistakes in an attempt to discover the thinking strategies students are using.

Reading Results, Grade Six

Test Scope and Foundations

In 1981-82 a new sixth grade test, the Survey of Basic Skills: Grade 6, was administered for the first time.

The reading section of the Survey of Basic Skills: Grade 6 contains questions from six broad skill areas: (1) vocabulary; (2) literal comprehension; (3) inferential comprehension; (4) interpretive comprehension; (5) critical/applicative comprehension; and (6) study-locational skills. These skill areas reflect the emphases in the Reading Framework for California Public Schools, Handbook for Planning an Effective Reading Program, and state-adopted reading textbooks commonly used at the sixth grade level.

Decisions about the relative emphasis and breadth of content for each of these skill areas were made by the Reading Assessment Advisory Committee, a group of reading specialists representing a cross section of geographical regions, educational institutions, instructional levels, and professional groups throughout California. In making these decisions, the committee members considered information from field reviews of preliminary test content specifications. The results indicated the degree of emphasis placed on each skill area and whether or not the skill should be assessed on the Survey. These field reviews reflected district, school, and teacher points of view.

After careful consideration of the reading framework and field review information, the reading committee decided that the area of comprehension should receive the greatest emphasis in the reading section of the Survey. This decision was also consistent with the state-adopted Handbook for Planning an Effective Reading Program, which includes the following statement: "Comprehension is the central goal of reading" (page 7). Thus, approximately 75 percent of the reading questions are comprehension items.

The major features of the reading section of the Survey of Basic Skills: Grade 6 are highlighted below:

- The new reading test reflects the new Reading Framework for California Public Schools, which emphasizes comprehension development, higher-level thinking, reading in the content areas, and promotion of positive attitudes toward reading in order to establish a lifelong desire to read.

- Content area reporting is a new feature of the revised Survey. Comprehension and vocabulary scores are reported for science, social studies, and literature.

The relative degree of emphasis assigned to each of the reading skill areas in the Survey is presented graphically in Figure 5. For an illustrated description of all reading skill areas and underlying rationale, see Survey of Basic Skills: Grade 6, Rationale and Content (Sacramento: California State Department of Education, 1982).

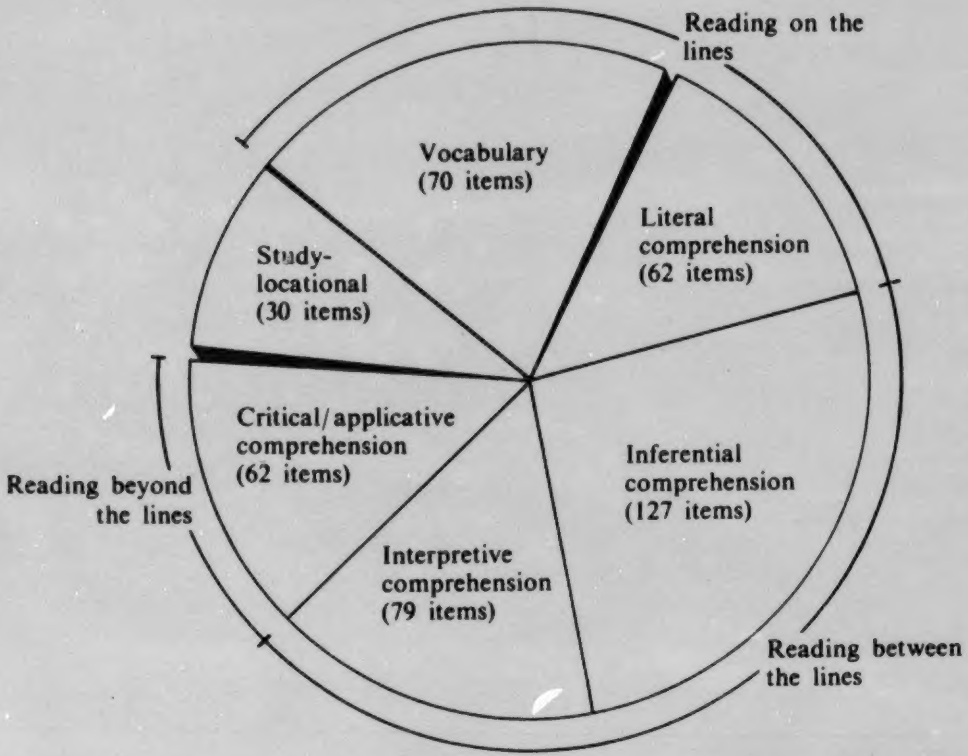


Fig. 5. Number of questions, by skill area, in the reading portion of the *Survey of Basic Skills: Grade 6*

Reading Results for Grade Six

The Survey of Basic Skills: Grade 6 was administered for the first time in 1981-82. The results of sixth graders' performance on the reading section of this test are shown in Table 3.

Table 3

Reading Scores of California Sixth Grade Students on the *Survey of Basic Skills: Grade 6*, 1981-82

Skill area	Number of questions	Mean score
READING, TOTAL	430	71.5
Vocabulary	70	70.1
Prefixes, roots, and suffixes	16	67.0
Recognizing word meanings	37	67.7
Using context with multiple-meaning words	17	78.1
Comprehension	330	71.2
Literal	62	76.7
Details	31	80.1
--from single sentence	14	80.2
—from two or three sentences	17	80.0
Pronoun references	16	74.3
Sequence	15	72.4
Inferential	127	67.3
Main idea	16	73.4
Cause and effect	15	75.6
Following organization	16	56.0
Putting information together	15	62.5
Predicting outcomes	18	69.3
Making comparisons and contrasts	17	60.6
Drawing conclusions from details	16	65.1
Drawing conclusions from overall meaning	14	75.3
Interpretive	79	74.9
Analyzing characters	18	75.6
Undestanding setting	12	78.4
Summarizing plot	13	73.4
Understanding dialogue	12	77.2
Sensing mood	12	67.1
Understanding figurative language	12	77.4

Reading Results, Grade Six

Table 3 (cont.)

Skill area	Number of questions	Mean score
Critical/applicative comprehension	62	68.7
Detecting author and author's attitude	12	66.1
Detecting author's purpose	19	72.7
Separating fact from opinion	16	66.8
Applications to a different context	15	67.9
Study-Locational skills	30	77.4
Reference materials and parts of a book	15	81.8
Maps, graphs, and charts	15	73.1
Reading in the content areas		
Vocabulary--Word meanings	37	67.7
In reading and literature	13	71.2
In science	11	71.1
In social studies	13	61.3
Comprehension of literature passages	117	74.3
Literal	17	79.5
Inferential	29	72.0
Interpretive	61	74.7
Critical/applicative	10	69.9
Comprehension of science passages	103	68.0
Literal	17	76.5
Inferential	58	65.4
Critical/applicative	28	68.4
Comprehension of social studies passages	107	70.8
Literal	28	75.2
Inferential	40	66.7
Interpretive	15	77.0
Critical/applicative	24	68.7

Reading Results, Grade Six

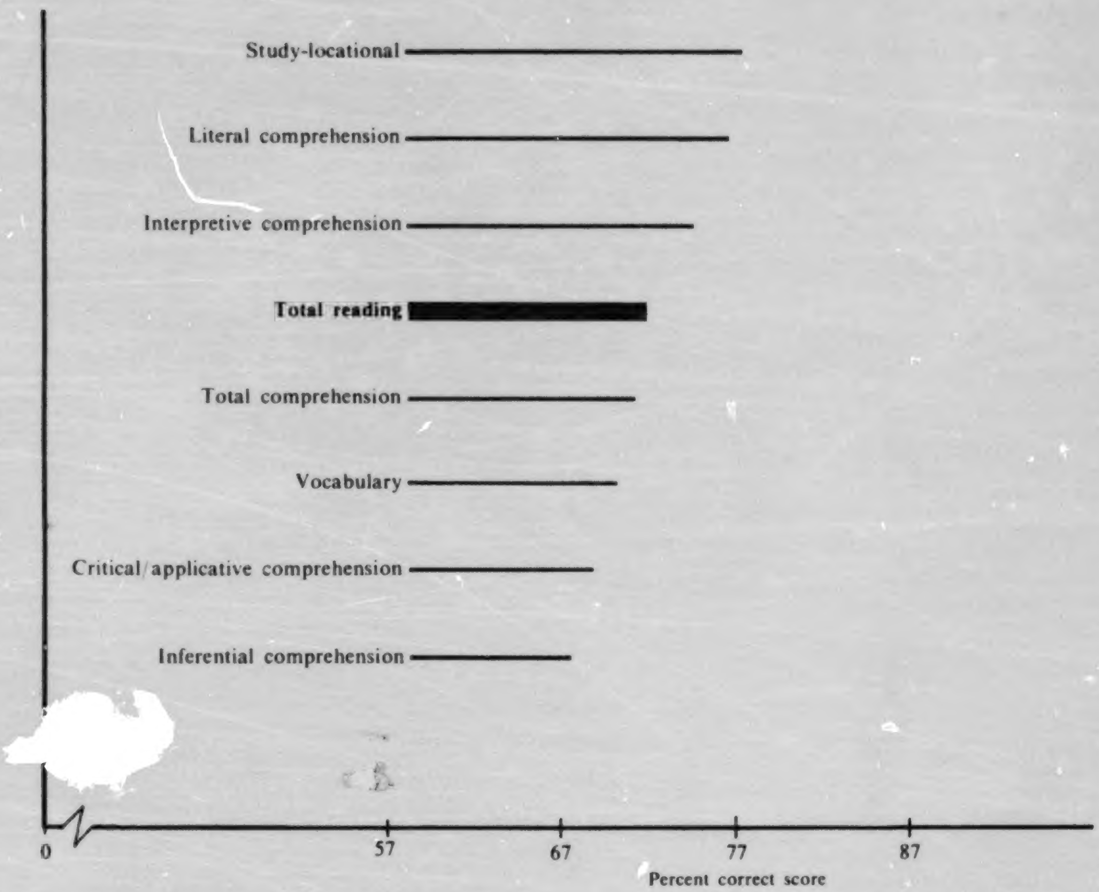


Fig. 6. Percent correct scores of California sixth grade students for the major skill areas in reading, 1981-82

The following observations are evident from the data in Table 3.

- The highest score was registered for using reference materials and parts of a book (81.8 percent correct) followed by details from a single sentence (80.2 percent correct), and details from two or three sentences (80.0 percent correct.)
- The lowest score was registered for following organization (58.0 percent correct), which is a subskill under inferential comprehension.
- In reading in the content areas, the highest score was registered for comprehension of literature passages (74.3 percent correct), while the lowest score was registered for comprehension of science passages (68.0 percent correct).

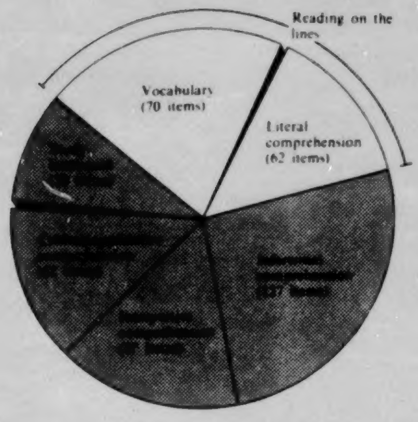
Reading Results, Grade Six

Interpretation of Skill Area Results, Grade Six

The members of the Reading Assessment Advisory Committee, a panel of distinguished California educators with recognized expertise in reading instruction and assessment, analyzed, interpreted, and evaluated the 1981-82 reading results for grade six. In this process, they examined the scores in the reading skill areas in light of the philosophy underlying the CAP reading tests. This philosophy is stated generally in the Reading Framework for California Public Schools and more specifically in Survey of Basic Skills: Grade 6, Rationale and Content. In accordance with the Reading Framework, the committee's analysis of the results focused on the following broad categories: "Reading on the lines," "Reading between the lines," "Reading beyond the lines," and "Reading in the content areas."

Reading on the lines...

"Reading on the lines" refers to the most fundamental level of comprehension and involves questions that require students to respond to information explicitly stated in the text. These skills, as they are assessed on the Survey of Basic Skills: Grade 6, include vocabulary and literal comprehension, which are described and illustrated below.



- Vocabulary items assess the ability to identify meanings of words used in a passage. Test words cover core science and social studies, as well as general vocabulary. Vocabulary items also assess understanding of common roots, prefixes and suffixes, and the ability to use the context of the passage to identify the meaning of a multiple-meaning word (for example, "saw," "run," and "bark").
- Literal comprehension items assess the ability to answer literal questions, including sequence, details (explicitly derived from one, two, or three sentences in the reading passage), and pronoun references (Jack is a boy. He is a good reader. ....Question: Who is a good reader? Answer: Jack).

Sample items from illustrative science passage

Some kinds of fish need to be cleaned of the parasites that feed on them. If the parasites stay on the fish, sores can form.

In the Pacific Ocean are small cleaner fish called wrasses. The wrasses get their food by removing parasites from the head and gills of other fish. Many large and dangerous fish come to them to be cleaned.

To get customers, a wrasse usually sets up business near a busy spot. Its cleaning station may be a rock or patch of white sand. When another fish swims near the station, the wrasse does a kind of dance to catch the fish's attention. If the fish wants to be cleaned, it holds quite still.

Sometimes a large group of fish wait to be cleaned at a wrasse's cleaning station. In the group are many different kinds of fish, such as jacks, parrotfish, eels, bass, or sunfish.

A wrasse uses its teeth and jaws to remove the parasites from the customer's body. The wrasse may want to clean under the customer's fin. It gives the other fish a gentle push and the customer lifts its fin. If the wrasse wants the customer to open its mouth, it pokes between the fish's teeth and lips.

In this passage, parasites means

○ friends who stop to chat.
○ many different kinds of fish.
○ fish that eat smaller fish.
○ animals that live on another animal.

Where are the small cleaner fish?

○ in the Atlantic Ocean
○ in rivers and streams
○ in lakes and ponds
○ in the Pacific Ocean

Reading Results, Grade Six

The percent correct scores for vocabulary and literal comprehension are shown numerically and graphically in Figure 7.

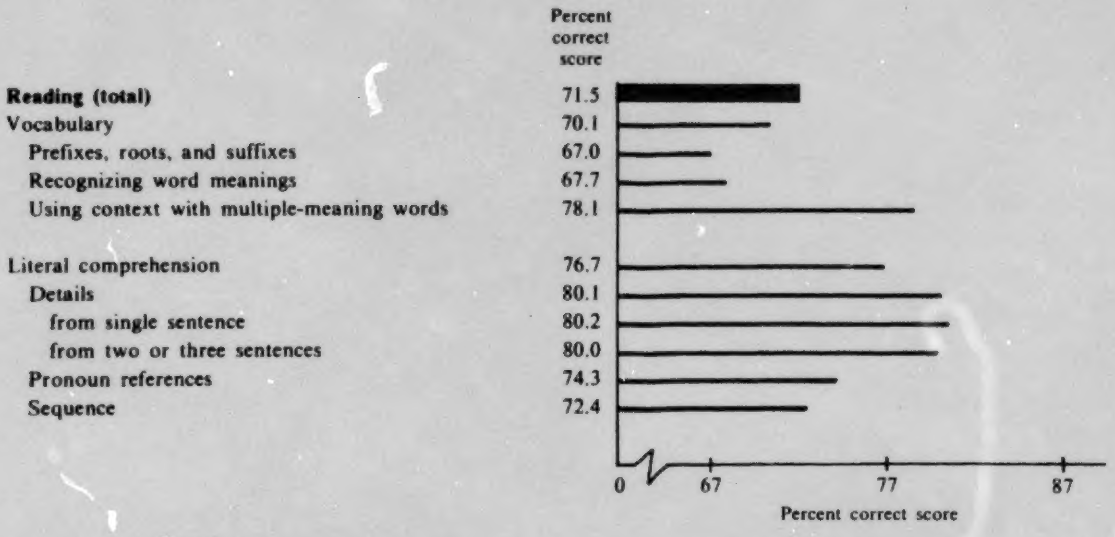


Fig. 7. Percent correct scores of California sixth grade students for the reading skill areas of vocabulary and literal comprehension, 1981-82

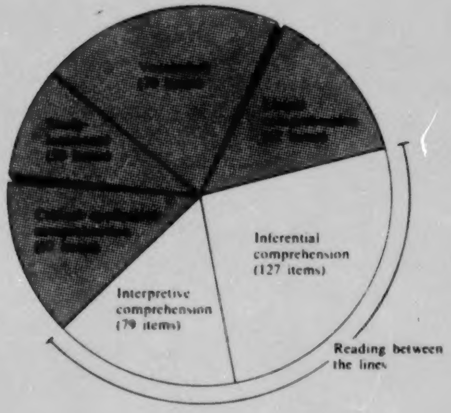
The members of the Reading Assessment Advisory Committee were pleased to see the generally high scores for vocabulary (70.1) and literal comprehension (76.7). They noted that the scores for all literal comprehension skills were higher than the total reading score of 71.5. Some committee members commented that the display of strength shown in literal comprehension clearly reflects the continued emphasis of elementary classroom instruction on literal-level responses.

The committee members were equally pleased to observe the relatively high score (78.1 percent correct) for the questions on use of context. These items require students to use the context of written material to identify the meaning of a common multiple-meaning word (such as "fall" or "pen".) The members of the committee were gratified to see that this type of question, which caused considerable difficulty for third graders, has become a relative strength for sixth graders. This improvement from grade three to grade six is apparently the result of strong instructional efforts and/or conceptual gains in literal and contextual comprehension in the intermediate grades. However, the committee members also noted the lower scores in the other two vocabulary skills: prefixes, roots, and suffixes (67.0) and recognizing word meanings (67.7). These clusters of questions require knowledge of vocabulary above and beyond what can be determined through the use of context. The items in the recognizing word meanings category are composed of common words from the basic curriculum areas of literature, science, and social studies. Because vocabulary knowledge is so crucial to comprehension across the curriculum, the members of the committee concluded that more emphasis is needed on vocabulary development through oral language activities, broad and varied reading, and direct instruction.

Reading Results, Grade Six

Reading between the lines...

"Reading between the lines" refers to the higher-level thinking skills that students must use to respond with ideas or opinions that are based on the material read but that are not stated explicitly in the material. These skills, as they are assessed on the Survey of Basic Skills: Grade 6, include inferential and interpretive comprehension skills, which are described and illustrated below.



- Inferential comprehension items assess the ability to identify main ideas, infer cause and effect relationships, follow the organization of a passage by supplying missing points of an outline, putting information together from different parts of a passage. Predicting logical outcomes, making comparisons and contrasts, drawing conclusions from details, and drawing conclusions from overall meaning.
- Interpretive comprehension items apply primarily to the literature passages as they assess the ability to analyze characters, infer setting, summarize plot, interpret dialogue, sense mood, and understand figurative language.

Sample items from an illustrative story

The beasts and birds of the dark woods were gathered around an old boot. They had come to find out what it was.

"There is no doubt about it," said the lion, pointing to the outside. "It is the shell of some kind of nut."

"Not at all," replied the wolf, putting his paw inside. "It is a nest. Here is a deep hole for the bird to go in and be safe with her eggs and young ones."

"No," said the bear, holding up a lace. "This is the long root of some plant."

"I can tell you what it is," hooted the wise old owl from a nearby tree. "It is a man's boot."

"What is a man?" cried the beasts and birds. "What is a boot?"

"A man," said the owl, "is a thing with two legs who can make himself go faster than we can, and he can fly without wings."

"That can't be true," said the beasts. "How can anything with two legs go faster than we can with four?"

"It can't be true. Nothing without wings can fly," the birds added angrily.

"Well," the owl continued, "they make things like this and put them on their feet."

Reading Results, Grade Six

"Shame, shame," cried all the beasts and birds. "No one wears things on their feet. It's not true. You are not fit to live with us."

So they chased the poor old owl out of the woods and never let him come back.

One conclusion to be drawn from this story is that

o the lion is truly the "King of the Jungle."
o new ideas are not easily accepted.
o flying is not possible without wings.
o truth is always quickly recognized.

The beasts and birds can best be described as

o proud and closed-minded.
o understanding and wise.
o sleepy and lazy.
o thrifty and hard-working.

The percent correct scores for inferential and interpretive comprehension are shown numerically and graphically in Figure 8.

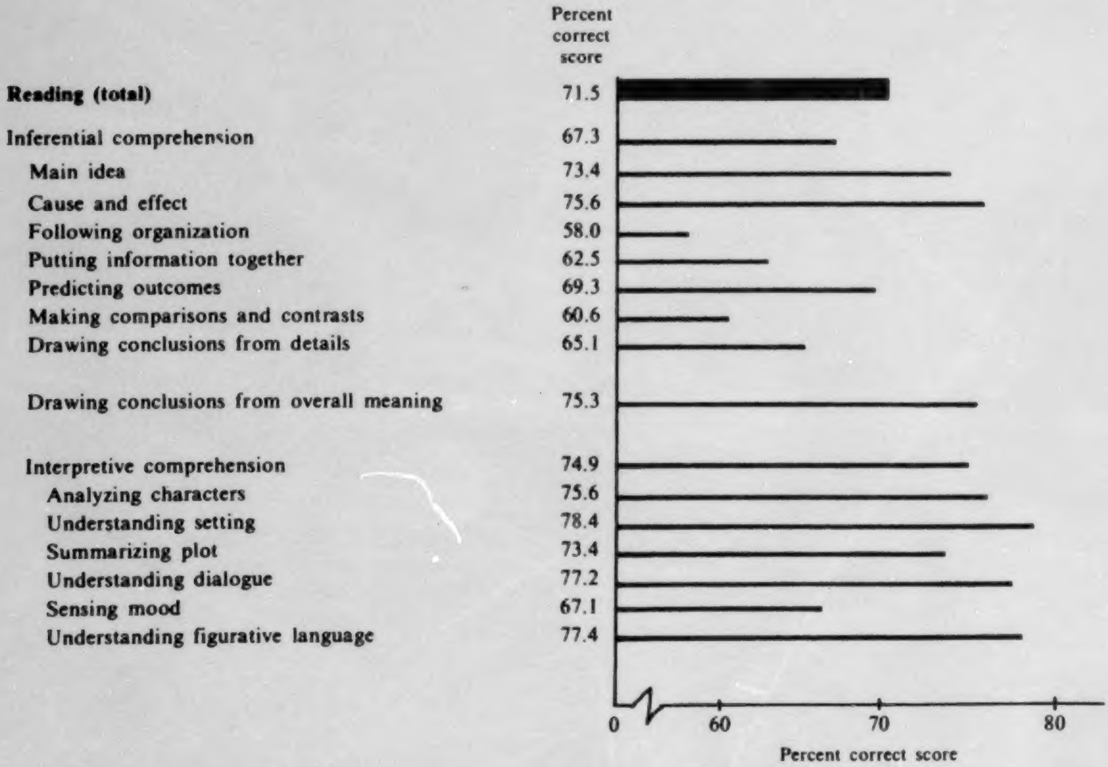


Fig. 8. Percent correct scores of California sixth grade students for the reading skill areas of inferential and interpretive comprehension, 1981-82

Reading Results, Grade Six

The members of the Reading Assessment Advisory Committee reviewed the scores for the inferential and interpretive skill areas with mixed emotions, noting that some of the lowest percent correct scores on the test were registered in these areas. As is apparent from a comparison of scores, most of the interpretive comprehension questions were easier for students than were the inferential comprehension items. In part, this difference in difficulty for students may be the result of most of the interpretive items being based on literature or social studies passages.

As is apparent from the list of skills in the interpretive comprehension category, most of the interpretive skills are associated with the study of literature. The advisory committee observed that scores above the total reading score of 71.5 percent correct were registered for five of the six interpretive comprehension skills. The one exception was the area of sensing mood, in which a score of 67.1 percent correct was registered. These questions require students to interpret the prevailing feeling or tone of a particular selection. As the members of the English Language Assessment Advisory Committee have repeatedly insisted, students need focused instruction in both reading and writing that will sensitize them to the emotional connotations of language.

In the area of inferential comprehension, the highest scores were registered for those skills requiring students to infer the primary message of the material, skills such as drawing conclusions from overall meaning (75.3 percent correct) and identifying main ideas (73.4 percent correct). The most difficult inferential comprehension skills for sixth graders proved to be drawing conclusions from details (65.1 percent correct), putting information together (62.5 percent correct), making comparisons and contrasts (60.6 percent correct), and following organizations (58.0 percent correct).

Drawing conclusions from details has repeatedly appeared as a weakness at all grade levels and was the skill area at the third grade for which students registered the least amount of total gain from 1980-1982. Therefore, the low score in this area at the sixth grade did not surprise the committee members, especially since drawing conclusions from details is admittedly a difficult skill to learn--and to teach. It involves searching for a relevant detail, which may very well be buried in the text, and then drawing from it an appropriate inference.

Putting information together is another skill that is not easy to acquire, because this skill involves putting together two separate pieces of information, usually from totally different parts of the text, and drawing from them a conclusion not stated in the text. While this skill is difficult to teach, research has shown that it can be taught, even at the primary grade levels, if students are given focused instruction and practice.

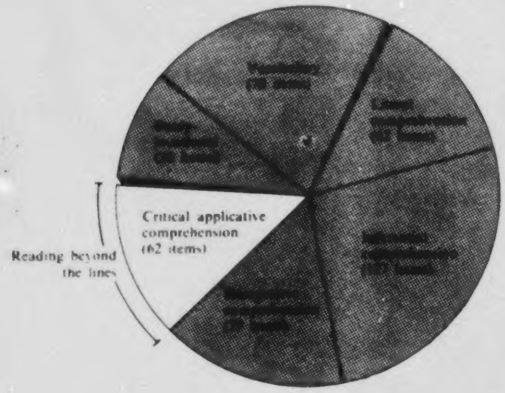
The comparison and contrast questions require students to compare or contrast some element from the reading passage to another element in the passage or to some thing, person, or idea not stated or identified in the passage. Since comparison and contrast is fundamental to both analytical and metaphorical thinking, the significance of this skill is considerable. Given its importance and the relatively low percent correct score (60.6) the members of the committee concluded that more time should be devoted to instructing students in the art of making comparisons and contrasts.

Reading Results, Grade Six

The advisory committee spent a good deal of time discussing the skill of following organization, for which the lowest score on the test (58.0) was registered. These questions require students to grasp the abstract organizational pattern underlying a paragraph or passage. The students must identify a missing topic or a detail missing from a partial outline of the passage. The committee members realized that this would be a difficult skill for sixth graders, but they included it on the test because it is commonly taught at the elementary school level and because understanding organization in writing is an important skill for sixth graders to begin mastering. While the low score in following organization came as no surprise to the committee, some committee members did point out that outlining exercises, which often are relegated to the back portions of study skills books, should not be neglected, since outlining is a time-honored method for nurturing the development of organizational skills.

Reading beyond the lines...

A third level of comprehension, referred to as "reading beyond the lines" or critical/applicative comprehension, is also identified in the Reading Framework. This is perhaps the highest level of comprehension and involves investigating, evaluating, and integrating information and ideas from the reading passage with one's own experience and/or appying them to a new context. Included in the category of critical/applicative comprehension are the four skills described and illustrated below.



- Critical/applicative items assess the ability to detect the author, author's attitude and author's purpose, separate fact from opinion, and make applications to a different context.

Reading Results, Grade Six

Sample items from illustrative social studies passage

In 1860, a Midwestern stagecoach company let people know about an exciting new plan which would affect our entire country. The company planned a faster mail service to California--the Pony Express, which would deliver the mail in ten days or less.

Strong young men were the riders. Buffalo Bill was one of the famous ones. These men had to have courage. Every day they faced many kinds of danger. They had been told, "Remember, you travel alone and the country is wild and rugged. You may be cold, hungry, wet and tired, but you must go on! The mail must go through!" And it did go through!

Over the saddle of the Pony Express horses was hung a leather blanket or "mochula." In the four pockets of it were the tissue-thin letters. Five dollars was the price for sending a letter.

The route cut directly across from Missouri to Sacramento. Each rider rode nonstop for about a hundred miles, and then a new rider took over. The horses were chosen for speed and were changed every ten miles. Quickly the mail was thrown over the saddle of the fresh horse, much like a relay race. Horses were saddled and ready to go at every station. With a leap, the rider was in the saddle--and off like the wind!

Which of the following is an example of an opinion?

- ○ "In 1860, a Midwestern stagecoach company let people know about an exciting new plan."
- ○ "The mail must go through."
- ○ "The route cut directly across from Missouri to Sacramento."
- ○ "Each rider rode nonstop for about a hundred miles."

If you had lived in Missouri in 1855 and had posted a letter to Sacramento, you can tell that it would have taken

- ○ longer than 10 days.
- ○ 10 days.
- ○ 5 days.
- ○ less than 9 days.

Reading Results, Grade Six

The scores for the critical/applicative comprehension skill areas are shown numerically and graphically in Figure 9.

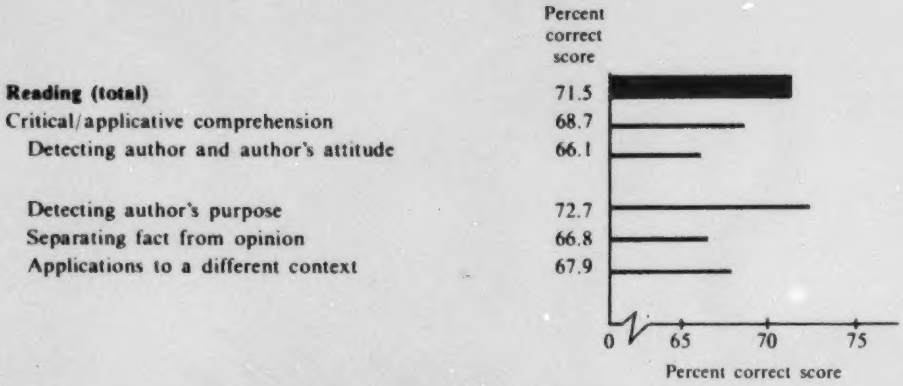


Fig. 9. Percent correct scores of California sixth grade students for the reading skill areas of critical/applicative comprehension, 1981-82

The members of the Reading Assessment Advisory Committee observed that most of the critical/applicative skills, like most inferential comprehension skill areas, registered scores below that for the total reading test (71.5). The members of the committee concluded that students need more opportunities to work on the critical/applicative skills (detecting author and author's purpose, separating fact from opinion, and making applications to new contexts) in order to help them develop critical and active reading style, which is needed both in and out of school.

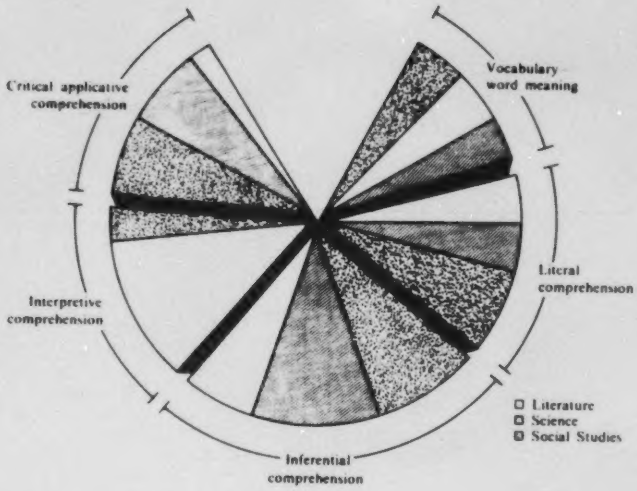
Reading in the content areas...

The comprehension scores were reaggregated to provide score breakouts for each of the three different types of passages: literature, science, and social studies. This feature was incorporated into the new Survey of Basic Skills: Grade 6 to reflect the widespread concern that the reading-thinking skills be taught across the curriculum, as is set forth in the following goal statement from the Reading Framework for California Public Schools (page 15):

> "Students will develop the ability to read with comprehension appropriate written materials used in the content areas of their school's curriculum."

The reorganization of the Survey of Basic Skills: Grade 6 is described and illustrated below.

Reading Results, Grade Six



Vocabulary and literal, inferential, interpretive, and critical/applicative comprehension were reaggregated by passage types: literature, science, and social studies. (There were no interpretive comprehension items based on science passages.)

The percent correct scores for each comprehension skill area, or by passage type, appear in Figure 10.

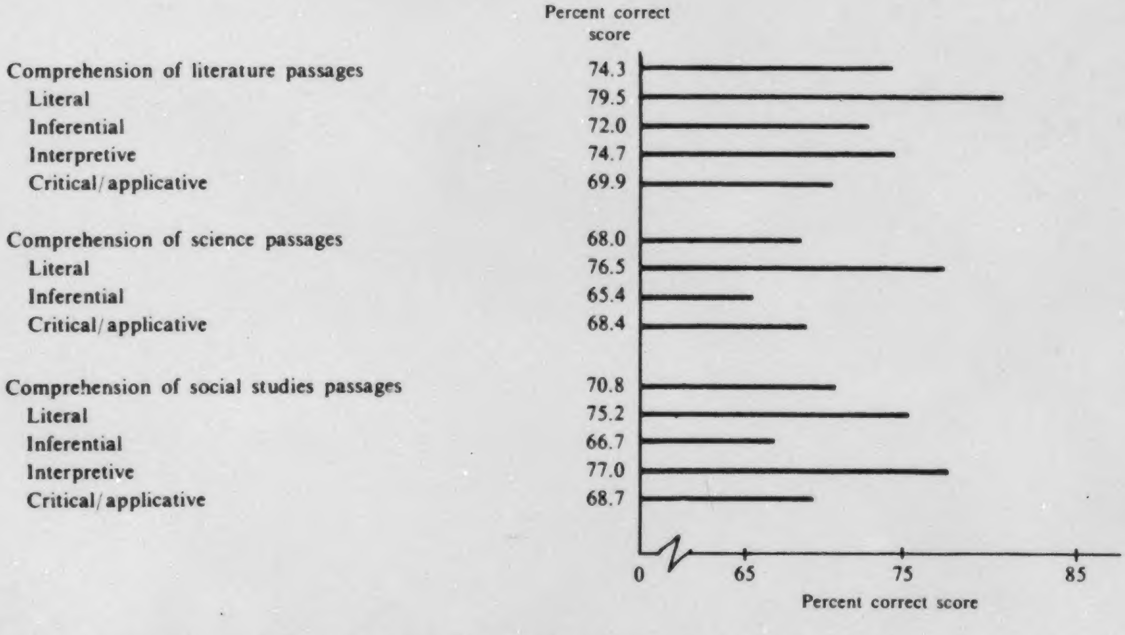


Fig. 10. Percent correct scores of California sixth grade students for the reading skill areas of vocabulary and comprehension, by passage type, 1981-82

Reading Results, Grade Six

The members of the Reading Assessment Advisory Committee observed a stair-step pattern of results across content areas moving in order of difficulty from literature to social studies to science. This result was not unexpected, however, given the following composite readabilities (including the Fry, Flesch, and Dale-Chall) for the three types of passages: literature (6.18), social studies (6.98), and science (7.28). Readability indexes are somewhat gross estimates and are best viewed as ranges rather than as precise, rigidly fixed numbers. In this case, the readability estimates do correlate with the percent correct scores in the three content areas.

The committee members further observed that in every content area the lowest scores were registered in either inferential comprehension or critical/applicative comprehension. These data reinforced their conclusion that instruction in "reading between the lines" and "reading beyond the lines" should be given high priority in all content areas across the curriculum.

After completing their analyses of the data from the new Survey of Basic Skills: Grade 6, the members of the committee offered the following instructional recommendations:

READING ASSESSMENT ADVISORY COMMITTEE'S INSTRUCTIONAL RECOMMENDATIONS FOR GRADE SIX

1. All higher level reading-thinking skills, including interpretive, inferential, and critical/applicative comprehension skills (or, more informally, "reading between the lines" and "reading beyond the lines") should receive high priority in all content areas across the curriculum.
2. In the development of the higher level reading-thinking skills, there is a necessity for discussion to improve students' thinking and thereby enable them to put information together, draw comparisons and contrasts, infer new conclusions, make applications to different contexts, and integrate new ideas into their experiences.
3. Reading, including comprehension and thinking in all disciplines across the curriculum, must be taught actively and creatively and must go beyond merely assigning and correcting worksheets.
4. The study of vocabulary should be intensified through oral language development, broad and varied reading, and direct instruction. Such instruction should include strategies for increasing student awareness of the emotional connotations of words.

Test Scope

The reading section of the Survey of Basic Skill: Grade 12 consists of 141 questions. These items were designed to assess students' attainment of a wide range of objectives discussed broadly in Framework in Reading for the Elementary and Secondary Schools of California (since updated as Reading Framework for California Public Schools: Kindergarten Through Grade Twelve) and specified, with the help of the Reading Assessment Advisory Committee, in Test Content Specifications for California State Reading Tests: Grades Two, Three, Six, and Twelve, (Sacramento: California State Department of Education, 1975.) As shown in Figure 11, both the objectives and the questions used to assess the achievement of the objectives fall into one of four reading skill areas: vocabulary, literal comprehension, interpretive/critical comprehension, and study-locational skills. Figure 11 is also an illustration of the emphasis placed on each of the reading skill areas in the Survey of Basic Skills: Grade 12.

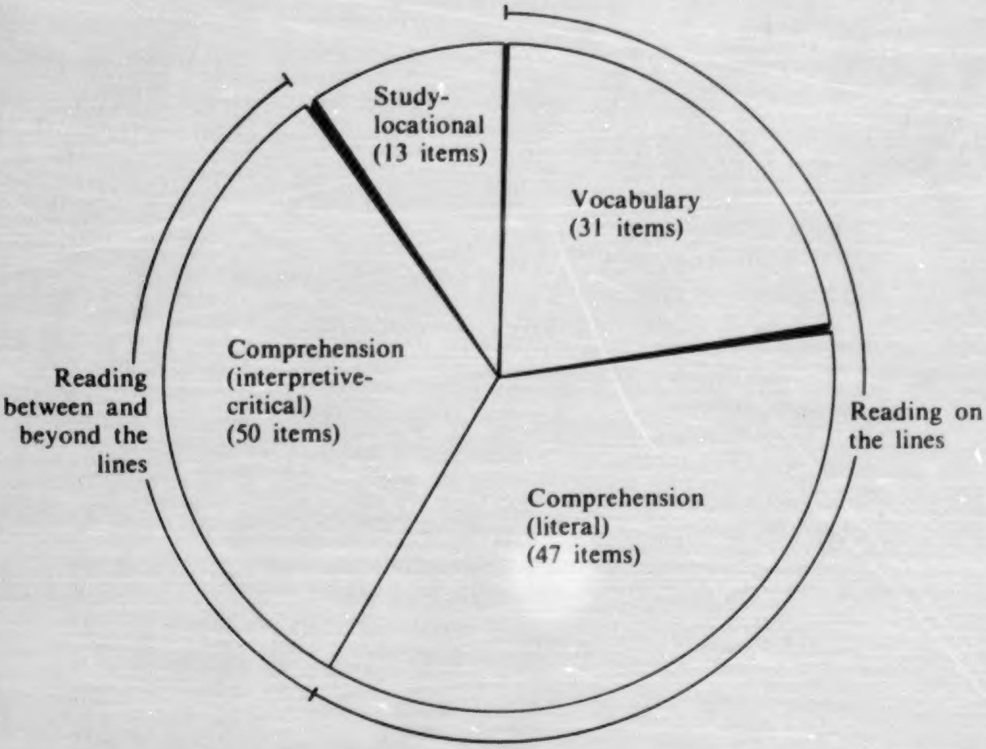


Fig. 11. Number of questions, by skill area, in the reading portion of the *Survey of Basic Skills: Grade 12*

Reading Results for Grade Twelve

For the seventh consecutive year, the Survey of Basic Skills: Grade 12 was administered to all California twelfth grade students. The reading achievement results from this test are shown in Table 4. Year-to-year changes in overall reading performance and in each of the reading skill areas are also shown in the table and illustrated graphically in Figure 12.

Table 4

Reading Scores of California Twelfth Grade Students on the Survey of Basic Skills: Grade 12, 1975-76 Through 1981-82

Skill area	Number of questions	Average percent correct score, by year, in each skill area							Change in average percent correct score 1980-81 to 1981-82	Total change 1975-76 to 1981-82
		1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82		
READING, TOTAL	141	64.1	63.6	63.3	63.2	63.1	63.4	63.2	-0.2	-0.9
Vocabulary	31	61.3	60.9	60.5	60.2	60.0	60.2	60.1	-0.1	-1.2
Comprehension	97	64.5	63.9	63.7	63.7	63.5	63.8	63.5	-0.3	-1.0
Literal	47	69.2	68.9	68.5	68.6	68.5	68.8	68.6	-0.2	-0.6
Interpretive/ critical	50	60.1	59.3	59.2	59.0	58.9	59.1	58.8	-0.3	-1.3
Study-locational	13	68.4	67.2	67.3	67.4	67.4	68.4	68.2	-0.2	-0.2

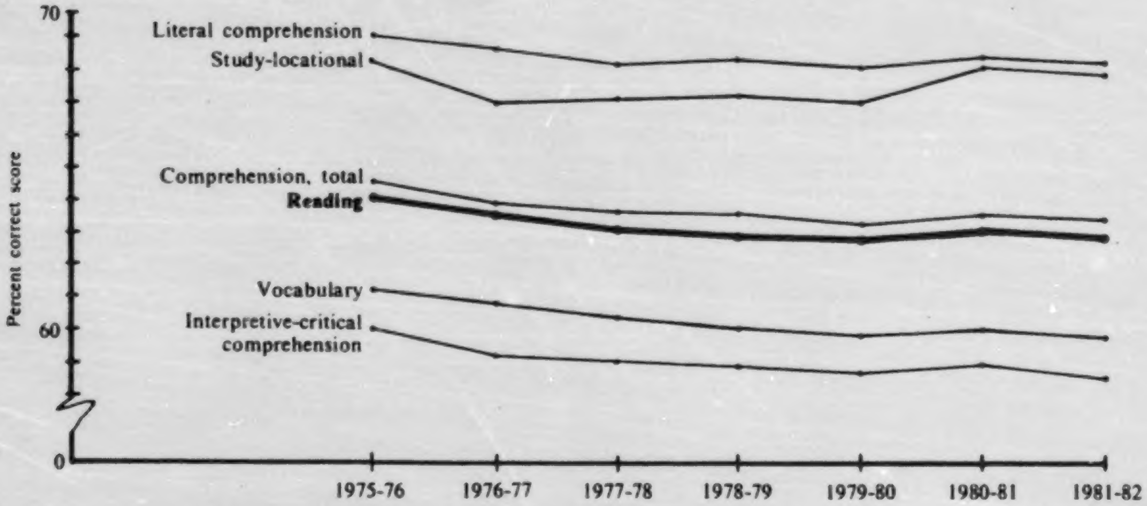


Fig. 12. Longitudinal trends of percent correct scores of California twelfth grade students for the skill areas in reading, 1975-76 through 1981-82

Reading Results, Grade Twelve

The following observations are evident from the data in Table 4:

- In 1981-82 California's high school seniors continued a generally downward trend since 1975-76 with a slight decline of 0.2 percent correct for the total reading section of the Survey. This overall downward trend was interrupted only once, from 1979-80 to 1980-81, during which a slight increase of 0.3 percent correct was registered. Twelfth graders in 1981-82 scored exactly as twelfth graders did in 1978-79, with an average percent correct of 63.2.

- Over the six-year period from 1975-76 to 1981-82, overall reading performance in grade twelve declined by 0.9 percent correct.

- Over the same six-year period, vocabulary and interpretive/critical comprehension showed the largest declines (-1.2 and -1.3 percent correct, respectively), while the least decline (-0.2 percent correct) was registered for study-locational skills.

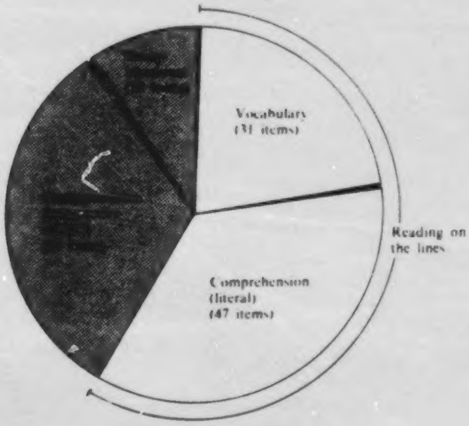
Interpretation of Skill Area Results, Grade Twelve

The members of the Reading Assessment Advisory Committee, a panel of distinguished California educators with recognized expertise in reading instruction and assessment, analyzed, interpreted, and evaluated the 1981-82 reading results for grade twelve. In this process, they examined the changes in skill area performance in light of the philosophy underlying the CAP reading tests, which is stated in the Reading Framework for California Public Schools.

The following discussion focuses on the two levels of comprehension assessed on the Survey of Basic Skills: Grade 12, using the terminology contained in Reading Framework for California Public Schools: (1) "Reading on the lines"; and (2) "Reading between and beyond the lines."

Reading on the lines...

"Reading on the lines" refers to the most basic level of comprehension and involves questions that require students to respond to information explicitly stated in the text. These skills, which include vocabulary and literal comprehension, are briefly described and illustrated below.



- Vocabulary items assess the ability to identify synonyms, antonyms, and definitions of words.

- Literal comprehension items assess the ability to identify or remember elements that have been explicitly stated in a passage.

Illustrative items

In the great revolt of 1910, reform-minded Congressmen stripped their autocratic Speaker, "Uncle Joe" Cannon, of the power to select committee chairmen and opted for a cleaner system: seniority. But yesterday's reform has a way of becoming today's reaction. Recently, liberal Democratic Congressmen staged a new uprising and all but consigned seniority to the history books. They deposed two of the crustiest dons in the House, at least temporarily, and gave two powerful chairmen the scare of their lives.

Actually, the fate of all four chairmen was left hanging in the balance for a time. But the shock waves from the quake already had produced lasting effects. Senate Democrats caught the mood by voting to select committee chairmen in the future by secret ballot, as their brethren in the House do already. And in both houses, reformers had broken the legislative stranglehold of committee chairmen, making them accountable at last to their peers.

The current reform described in these paragraphs was begun by:

○ Republican Congressmen
○ Democratic Congressmen
○ "Uncle Joe" Cannon
○ Democratic Senators

The word "peers" in the last sentence means:

○ other congressmen
○ the voters
○ Speakers of the House
○ committee chairmen

The 1981-82 percent correct scores and total changes in percent correct from 1975-76 to 1981-82 are shown below for vocabulary and literal comprehension.

	Percent correct, 1981-82	Changes from 1975-76 to 1981-82
Vocabulary	60.1	-1.2
Literal Comprehension	68.6	-0.6

The members of the Reading Assessment Advisory Committee noted that literal comprehension proved to be the easiest skill area for twelfth graders and that vocabulary was the second most difficult skill. The committee members also noted that the decline for a vocabulary was twice as great (-1.2 percent correct) from 1975-76 to 1981-82 as the decline for literal comprehension (-0.6 percent correct).

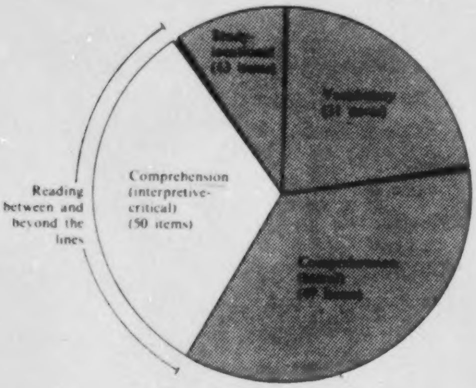
Reading Results, Grade Twelve

Because there have been consistent declines in performance in all reading areas at the twelfth grade, the members of the committee expressed concern that reading-thinking skills be emphasized in all curricular areas at the secondary level. They also noted the special importance of vocabulary in this process. As is stated in the Reading Framework (page 15):

> "...Some skills are common to all of the content areas, including the ability to: (1) set purposes for reading; (2) survey materials; (3) understand graphic and illustrative materials; and (4) locate, comprehend, and combine information from several sources.
>
> Each content area subject presents unique problems for the reader. If students are to comprehend the materials used in a content area subject, they must learn the vocabulary of the subject."

Reading between and beyond the lines...

"Reading between and beyond the lines" refers to the higher level thinking skills, termed interpretive-critical comprehension skills on the Survey of Basic Skills: Grade 12. These questions require students to respond "with ideas or opinions based on the material read but not stated explicitly in the text." This skill is briefly described and illustrated below.



- Interpretive-critical comprehension items assess the ability to relate, generalize, or infer from explicitly stated elements in written material.

Reading Results, Grade Twelve

Illustrative item

LYING IN A HAMMOCK
AT WILLIAM DUFFY'S FARM
IN PINE ISLAND, MINNESOTA

Over my head, I see the bronze butterfly,
Asleep on the black trunk,
Blowing like a leaf in green shadow.
Down the ravine behind the empty house,
The cowbells follow one another
Into the distances of the afternoon.
To my right,
In a field of sunlight between two pines,
The droppings of last year's horses
Blaze up into golden stones.
I lean back, as the evening darkens and comes on.
A chicken hawk floats over, looking for home.
I have wasted my life.

Which of the following best describes the speaker's hammock experience?

- ○ dullness
- ○ awareness
- ○ boredom
- ○ tranquillity

The 1981-82 percent correct score and overall change in percent correct from 1975-76 to 1981-82 are shown below for interpretive/critical comprehension.

	Percent correct, 1981-82	Total change, 1975-76 to 1981-82
Interpretive/critical comprehension	58.8	-1.3

The members of the Reading Assessment Advisory Committee observed that interpretive-critical comprehension is not only the most difficult reading skill area on the Survey of Basic Skills: Grade 12 (see Figure 12), but it is also the area showing the greatest overall decline (-1.3 percent correct) since the test was first administered. Thus, the committee again insisted that the higher level reading and thinking skills receive greater emphasis at the secondary level across the curriculum. The following statement from the Reading Framework (p. 15) succintly expresses the committee's position on this issue:

Reading Results, Grade Twelve

> "In order for students to comprehend written materials used in the content areas of the curriculum, they should receive instruction in the reading-thinking skills required in these areas....
>
> "The students who learn to generalize, to make judgments, to use problem solving techniques, and to reach conclusions have much greater assurance of experiencing success in the content areas than those who have not learned those skills."

The decline of California's twelfth grade performance in interpretive/critical comprehension paralleled that of the nation. In a recently published report by the National Assessment of Educational Progress, it was disclosed that nationally, the performance level of 17-year-olds had declined significantly (2.1 percent) in inferential comprehension.

In an earlier publication by the National Assessment of Educational Progress, Reading, Thinking, and Writing (1981), it was reported that students are not adept at supporting their own multiple-choice selections, analyzing materials to deepen understanding, or evaluating the materials they read. NAEP also found that boys and girls who never read in their spare time or who read only nonfiction scored below national levels. Experts called in by NAEP to interpret the results concluded that students who do not read or who read only nonfiction deprive themselves of those literary materials that appear critical to the building of imagination and to higher level reading skills.*

The members of the Reading Assessment Advisory Committee concluded their analysis with the following recommendations:

READING ASSESSMENT ADVISORY COMMITTEE'S RECOMMENDATIONS FOR GRADE TWELVE

1. Vocabulary in the content areas and higher level reading-thinking and problem-solving skills require greater instructional emphasis in all disciplines across the curriculum from grade seven through grade twelve.

2. Systematic attention should be devoted to finding more effective ways for content area teachers to teach students to learn from text in the various content areas. Such efforts might include identifying strong teaching models at the school site level, providing in-service training to meet the needs of content area teachers, and/or hiring qualified reading specialists at the secondary level.

3. Consideration should be given to the proposal to change the twelfth grade CAP testing to another level such as the end of the eleventh grade to allow time for corrective action if there are skill deficits.

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*NAEP newsletter, P.2.

IV. Written Language Achievement for Grades Three, Six, and Twelve

Synopsis of Findings

- Grade three written language scores improved in 1981-82, and gains were shown in all 34 skill areas.
- A new sixth grade test was administered for the first time in 1981-82. The results from an equating study show that gains in written language at grade six were registered for the sixth consecutive year.
- The twelfth grade total written language score increased 0.1 percent correct from 1980-81 to 1981-82, and gains were made in five of the seven skill areas.
- The median twelfth grade student in California is now scoring at the 35th percentile on national norms in written language, while the median sixth grader is at the 57th percentile, and the median third grader is at the 56th. (See Chapter VI, "Comparisons with National Norms.")

Committee Recommendations

After reviewing the data presented in the following three sections, the English Language Assessment Advisory Committee* offered the following recommendations:

Recommendations for Grade Three

1. Primary grade teachers should nurture fluency in students' own writing; a concern for correctness in language should not interfere with the major objective of nurturing this fluency.
2. More emphasis is needed in the area of language choices, which would offer primary grade children numerous opportunities to learn to use specific and sensory detail in their writing.
3. Efforts to develop sentence and paragraph sense in primary grade children should be continued through a wide variety of oral and written activities in which the child's active use of language is central.
4. The focus of instruction should be whole units of thought rather than fragmented pieces of language isolated from context.

Recommendations for Grades Six and Twelve

1. Writing instruction should include more writing, more teaching of writing, a greater variety of writing assignments, and adherence to the principles set forth in the Handbook for Planning an Effective Writing Program (Sacramento: California State Department of Education, 1982).

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*The names of the advisory committee members are listed in Appendix A.

2. Writing should be integrated with the teaching of reading in all the content areas.

3. While students are engaged in the act of writing, only the process skills of writing should be emphasized. Later, during the act of editing, the supporting skills of writing should be emphasized as the need arises.

4. Teachers should do more writing themselves, especially in the classroom with their students and on the topics they assign.

5. Various types of writing activities and events (such as writing celebrations, writing showcases, write-athons, writing fairs, and writing olympics) should be planned and conducted to emphasize the importance of writing and to provide out-of-classroom audience for students' writing.

6. California Assessment Program results as well as direct assessments of students' writing should be used for analyzing programmatic strengths and weaknesses and for setting goals.

Written Language Test Results for Grade Three

Test Scope and Foundations

The written language section of the Survey of Basic Skills: Grade 3 contains questions from eight skill areas that are divided into two main categories. The first is "Writing Process Skills," which deals primarily with matters of judgment in writing. The skills included in this category are (1) paragraphs; (2) sentence recognition; and (3) language choices. The other category, "Supporting Skills," is also a necessary part of writing instruction and includes the following skills: (4) standard English usage; (5) word forms; (6) capitalization; (7) punctuation; and (8) spelling. These skills reflect the goals and objectives stated in the English Language Framework for California Public Schools: Kindergarten Through Grade Twelve (Sacramento: California State Department of Education, 1976) and the Handbook for Planning an Effective Writing Program: Kindergarten Through Grade Twelve (Sacramento: California State Department of Education, 1982) as well as the major written language skills covered in state-adopted language textbooks commonly used in California's third grade classrooms.

Decisions concerning relative emphasis and breadth of context for each of the eight skill areas were made by the English Language Assessment Advisory Committee, which is composed of language arts experts representing a cross section of instructional levels and institutions from across the state.

The committee members considered the following sources of information during the test development process:

1. Content analyses of commonly used third grade language textbooks adopted by the State Board of Education

2. Field reviews of skill area compilations in which teachers and curriculum specialists indicated the degree of emphasis they assigned to each skill area and whether or not the skill in question should be assessed on the Survey

3. Reviews in which teachers judged each language item as to the degree of instructional emphasis placed on that particular skill and whether the item should be retained, modified, or omitted.

The language items were written to simulate actual production of written language as closely as possible within the restrictions of a multiple-choice testing format. Consequently, almost all the language items require pupils to select needed letters, words, or sentences for a blank in a word, sentence, or paragraph.

The relative degree of emphasis assigned to each of the written language skill areas within the two broad areas on the Survey of Basic Skills: Grade 3 is presented graphically in Figure 13.

Written Language Results, Grade Three

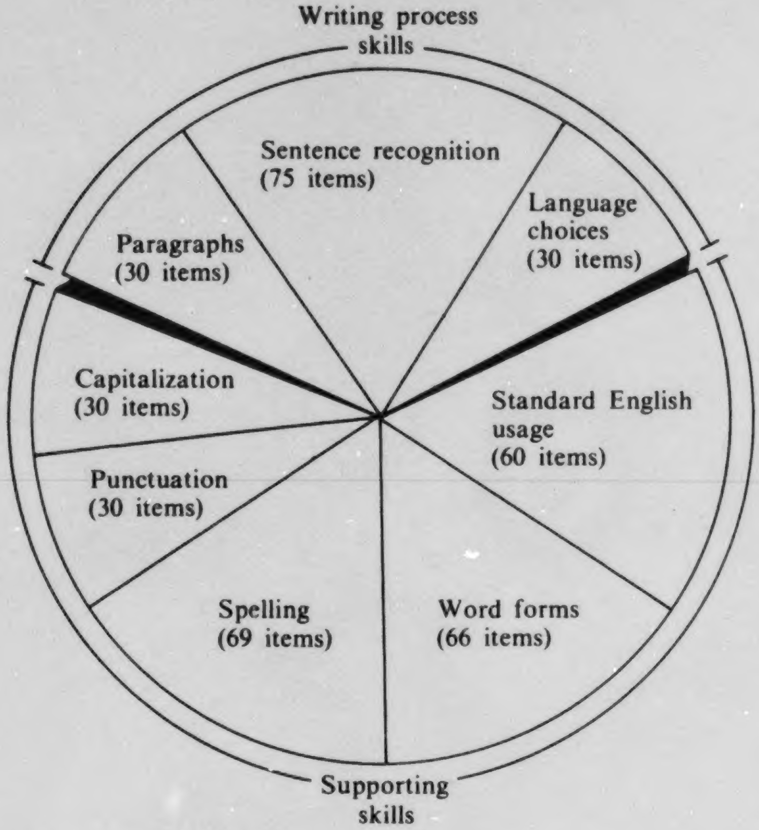


Fig. 13. Number of questions, by skill area, in the written language portion of the *Survey of Basic Skills: Grade 3*

Written Language Scores for Grade Three

The Survey of Basic Skills: Grade 3 was administered for the third successive year in 1981-82. The results of third grade performance on the language section of this test are shown in Table 5. Year-to-year changes in overall performance and in skill area performance are also shown in the table. The scores for written language and the eight major skill areas are shown graphically in Figure 14 for 1979-80 through 1981-82.

Written Language Results, Grade Three

Table 5

Written Language Scores of California Third Grade Students on the Survey of Basic Skills: Grade 3, 1979-80 Through 1981-82

Skill area	Number of questions	Mean score, by year			Change		Total change
		1979-80	1980-81	1981-82	1979-80 to 1980-81	1980-81 to 1981-82	1979-80 to 1981-82
WRITTEN LANGUAGE, TOTAL	390	74.8	75.4	76.6	+0.6	+1.2	+1.8
Writing Process Skills							
Paragraphs	30	69.6	70.0	71.3	+0.4	+1.3	+1.7
Topic sentence	15	68.4	68.8	70.1	+0.4	+1.3	+1.7
Details and sequence	15	70.9	71.3	72.5	+0.4	+1.2	+1.6
Sentence recognition	75	78.4	79.1	80.5	+0.7	+1.4	+2.1
Statements and questions	15	74.1	74.9	76.1	+0.8	+1.2	+2.0
Complete sentences	60	79.5	80.2	81.7	+0.7	+1.5	+2.2
Supplying subjects	30	78.8	79.5	80.8	+0.7	+1.3	+2.0
Supplying verbs	30	80.3	80.9	82.5	+0.6	+1.6	+2.2
Language choices	30	66.1	67.0	68.6	+0.9	+1.6	+2.5
Sensory words	15	72.1	73.0	74.1	+0.9	+1.1	+2.0
Specific words	15	60.2	61.0	63.1	+0.8	+2.1	+2.9
Supporting Skills							
Standard usage	60	74.2	74.4	75.1	+0.2	+0.7	+0.9
Irregular verbs	15	76.7	76.6	77.3	-0.1	+0.7	+0.6
Pronouns	15	73.5	73.8	74.4	+0.3	+0.6	+0.9
Subject-verb agreement	16	69.3	69.5	70.4	+0.2	+0.9	+1.1
Noun determiners	14	78.0	78.5	78.9	+0.5	+0.4	+0.9
Word forms	66	74.9	75.2	76.0	+0.3	+0.8	+1.1
Prefixes	14	79.1	79.4	79.9	+0.3	+0.5	+0.8
Inflectional suffixes	12	76.3	76.6	78.0	+0.3	+1.4	+1.7
Derivational suffixes	11	76.3	76.8	77.3	+0.5	+0.5	+1.0
Irregular noun plurals	14	65.1	64.8	65.2	-0.3	+0.4	+0.1
Contractions	15	77.8	78.9	80.0	+1.1	+1.1	+2.2
Spelling	69	73.0	73.5	74.6	+0.5	+1.1	+1.6
Predictables	39	80.4	80.7	81.7	+0.3	+1.0	+1.3
Words with suffixes	16	55.5	56.3	57.5	+0.8	+1.2	+2.0
Demons and homophones	14	72.4	73.2	74.3	+0.8	+1.1	+1.9
Capitalization	30	88.1	89.2	90.1	+1.1	+0.9	+2.0
Persons	10	90.9	91.6	92.4	+0.7	+0.8	+1.5
Places	10	87.3	88.5	89.4	+1.2	+0.9	+2.1
Days/months	10	86.0	87.5	88.5	+1.5	+1.0	+2.5
Punctuation	30	72.0	73.3	74.9	+1.3	+1.6	+2.9
Periods and question marks	10	77.8	79.0	80.8	+1.2	+1.8	+3.0
Commas	10	62.4	63.7	65.2	+1.3	+1.5	+2.8
Apostrophes	10	75.7	77.1	78.7	+1.4	+1.6	+3.0

Written Language Results, Grade Three

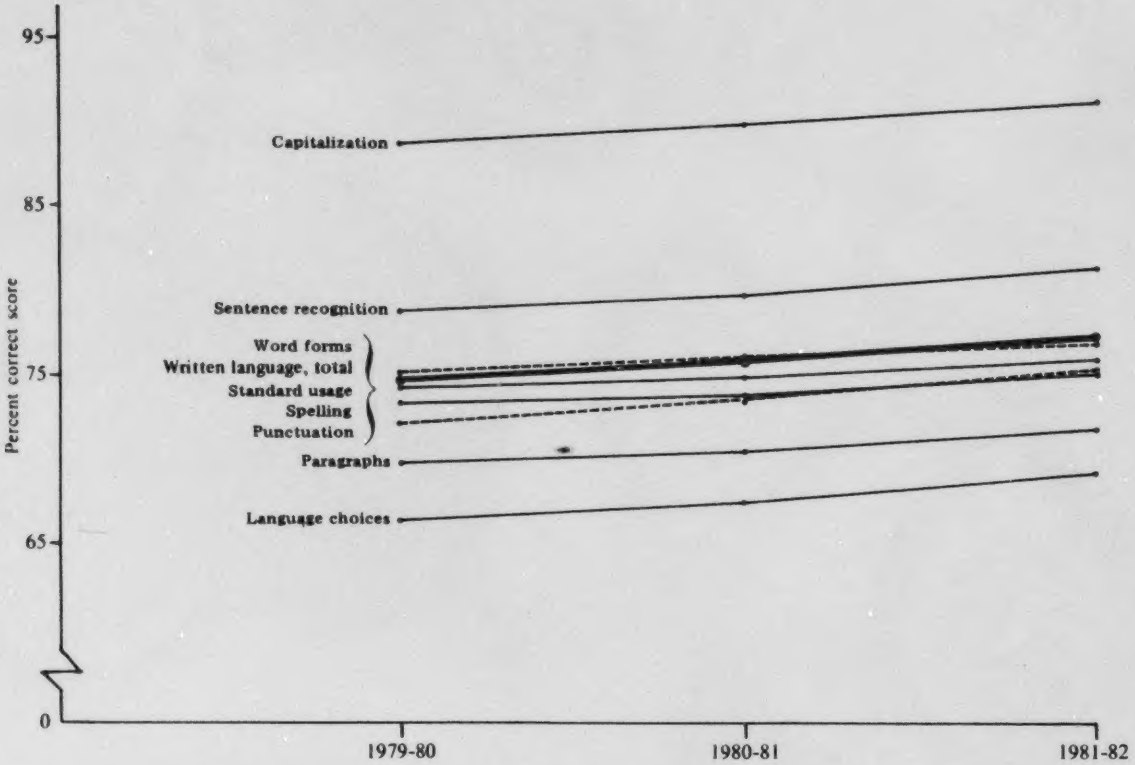


Fig. 14. Longitudinal trends of percent correct scores of California third grade students for the skill areas in written language, 1979-80 through 1981-82

The following observations are evident from the data in Table 5:

- The written language score for California's third grade students increased by 1.2 percent correct from 1980-81 to 1981-82, and gains were made in all 34 skill areas. The gain of 1.2 percent correct was exactly twice that of the previous year for written language (0.6 percent correct), yielding an overall gain of 1.8 percent correct from 1979-80 to 1981-82.

- The largest gain from 1980-81 to 1981-82 was in the area of specific words (2.1 percent correct), which is a language choices subskill.

- The smallest gains from 1980-81 to 1981-82 were in the areas of irregular noun plurals (0.4 percent correct) and noun determiners (0.4 percent correct).

- The largest gains over the two-year period from 1979-80 to 1981-82 were registered for the following skills:

Punctuation	2.9
Periods and question marks	3.0
Commas	2.8
Apostrophes	3.0
Specific words	2.9

- The smallest gain from 1979-80 to 1981-82 was in the area of irregular noun plurals (0.1 percent correct).
- The easiest major skill area on the third grade written language test was capitalization (90.1 percent correct). Similarly, the easiest subskill element was capitalization of persons' names (92.4 percent correct).
- The most difficult major skill areas were language choices (68.6 percent correct) and paragraphs (71.3 percent correct). The most difficult subskill element was spelling words with suffixes (57.5 percent correct).

Interpretation of Skill Area Results, Grade Three

The members of the English Language Assessment Advisory Committee, a panel of distinguished California educators with recognized expertise in language arts instruction and assessment, analyzed, interpreted, and evaluated the 1981-82 written language results for grade three. In this process, they examined the changes in skill area performance in light of the rationale underlying the CAP reading tests, which is stated generally in the English Language Framework for California Public Schools and more specifically in Survey of Basic Skills: Grade 3, Rationale and Content.

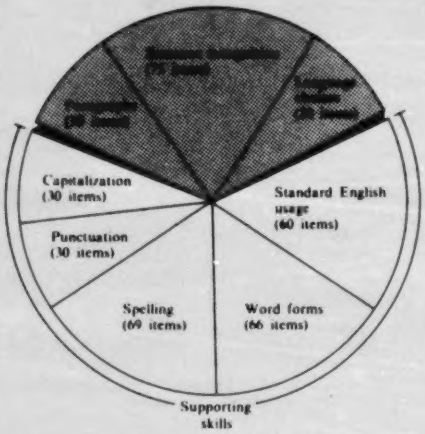
The following discussion focuses on the two broad clusters of skill areas assessed on the Survey of Basic Skills: Grade 3: (1) supporting skills; and (2) writing process skills.

Supporting skills...

"Supporting skills" is the term chosen by the committee for those areas of the test that deal with correctness: standard usage, word forms, spelling, capitalization, and punctuation. These areas are briefly described and illustrated below.

Written Language Results, Grade Three

Supporting Skills--Written Language, Survey of Basic Skills: Grade 3



- Standard English usage items assess the ability to use verbs and pronouns, and to achieve agreement in number between subject and verb, and between a noun determiner (for example, "this", "these", "that") and the noun it modifies.

Maria and ___ went to the store.

○ me
○ I
○ her
○ him

- Word form items assess the ability to form words with prefixes and suffixes, irregular noun plurals (for example, "geese," "children," and "shelves"), and contractions.

The valley race was won by two ________.

○ women
○ woman
○ womans
○ womens

- Spelling items assess the awareness of predictably spelled words and words with suffixes. A few familiar spelling demons are also included among the spelling items in addition to several homophones (for example, "bear" and "bare").

At the beach, Julie put water in her red bu__et.

○ ck
○ ch
○ k
○ kc

- Capitalization items require pupils to select words (such as names, places, and holidays) which are correctly capitalized.

There are many whales in the ________ ______.

○ Pacific Ocean
○ Pacific ocean
○ pacific ocean
○ pacific Ocean

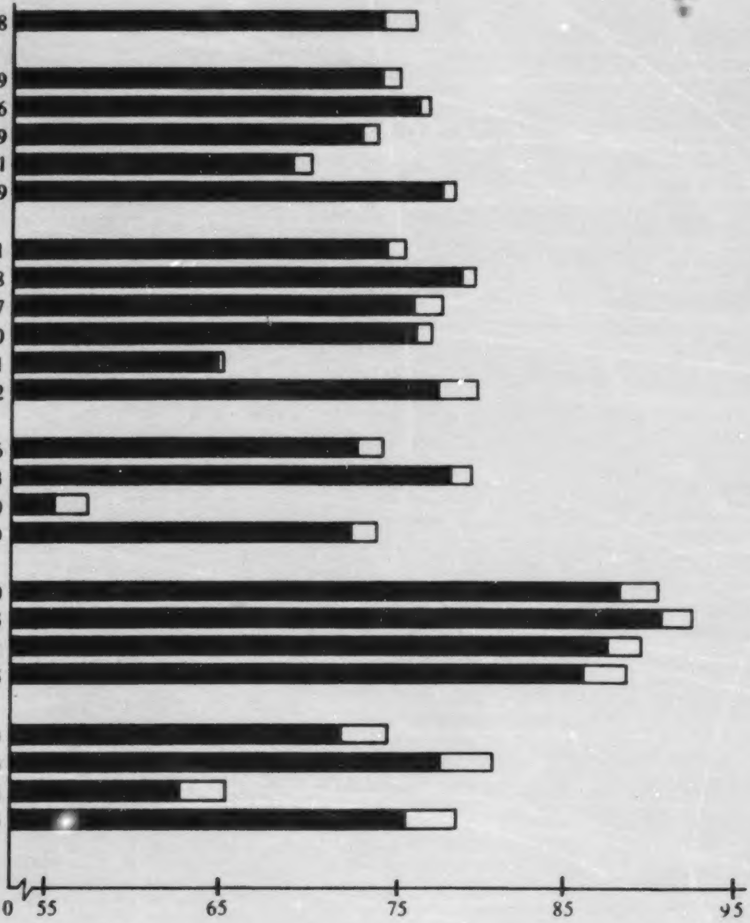
- **Punctuation** items require pupils to use periods, question marks, commas, and apostrophes correctly.

They heard a loud ___

○ cry
○ cry,
○ cry'
○ cry.

The percent correct scores for the written language supporting skills are shown in Figure 15 for 1981-82, along with the cumulative percent correct gains from 1979-80 to 1981-82.

	Percent correct score, 1981-82	Total change, 1979-80 to 1981-82
Written language (total)	76.6	+1.8
Standard usage	75.1	+0.9
Irregular verbs	77.3	+0.6
Pronouns	74.4	+0.9
Subject-verb agreement	70.4	+1.1
Noun determiners	78.9	+0.9
Word forms	76.0	+1.1
Prefixes	79.9	+0.8
Inflectional suffixes	78.0	+1.7
Derivational suffixes	77.3	+1.0
Irregular noun plurals	65.2	+0.1
Contractions	80.0	+2.2
Spelling	74.6	+1.6
Predictables	81.7	+1.3
Words with suffixes	57.5	+2.0
Demons and homophones	74.3	+1.9
Capitalization	90.1	+2.0
Persons	92.4	+1.5
Places	89.4	+2.1
Days/months	88.5	+2.5
Punctuation	74.9	+2.9
Periods and question marks	80.8	+3.0
Commas	65.2	+2.8
Apostrophes	78.7	+3.0



■ Percent correct score, 1979-80
□ Percent correct score, 1981-82

Fig. 15. Percent correct scores of California third grade students for the supporting skills within written language, 1981-82, and changes in scores, 1979-80 to 1981-82

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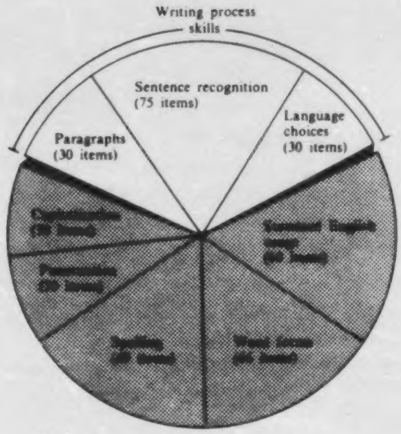
The members of the committee were very pleased with the gains shown for all supporting skills within written language. From the data in Figure 15 they noted that the following supporting skills areas were particularly difficult for third graders: spelling words with suffixes (57.5 percent correct), irregular noun plurals (65.2 percent correct), and punctuation with commas (65.2 percent correct). The subskills that were strikingly easy for California's third graders were all within the area of capitalization--names of persons (92.4 percent correct) places (89.4 percent correct), and days/months (88.5 percent correct)--followed by spelling of predictable words (81.7 percent correct), punctuation with periods and question marks (80.8 percent correct), and contractions (80.0 percent correct). The committee commented that the third grade pattern of strengths and weaknesses should be useful for planning in both the intermediate grades (and especially fourth grade) and the primary grades.

The committee observed that the skill areas showing the greatest increases since 1979-80 are not necessarily the easiest areas for pupils: punctuation with commas (2.8 percent correct) and spelling words with suffixes (2.0 percent correct). The committee members were pleased to see such consistent progress in all supporting skills, especially in the more troublesome areas of spelling and punctuation.

Writing Process Skills

The writing process skills tend to deal more with matters of judgment in writing than with matters of correctness, and they tend to be more central to the process of writing. On the Survey of Basic Skills: Grade 3 writing process skills areas include paragraphs, sentence recognition, and language choices, which are described and illustrated below.



Written Language Results, Grade Three

- **Paragraph** items assess the ability to choose a sentence for a blank in a paragraph which will make sense in the context of the paragraph; these items include topic sentences, relevant details, and necessary sequential elements.

____

___. They can wash windows or cars. They can cut the grass and rake leaves. They can even earn money by setting up a lemonade stand.

o More children drink lemonade in the spring and summer.

o Many nine-year-olds are good at cleaning.

o There are many ways for nine-year-olds to earn money.

o Raking leaves is tiring work for children.

- **Sentence recognition** items test the ability to form a complete sentence by supplying a needed subject or verb, and to discriminate between questions and statements.

The black bear ________________.

o in the cave
o was walking around
o from the mountain
o under the tree

- **Language choice** items assess the ability to select words which appeal to a given sense (for example, a word such as "buzzing" would be associated with the sense of sound), and to select the most specific word in a list of related words (for example, the word "hamburger" would be identified as more exact than "food" or "thing").

Choose the one that tells exactly what Lee tasted.

Lee tasted the _____ on his plate.

o food
o vegetable
o corn

The percent correct scores for the writing process skills within the third grade written language test are shown in Figure 16 for 1981-82, along with the cumulative percent correct gains from 1979-80 to 1981-82.

Written Language Results, Grade Three

	Percent correct score, 1981-82	Total change, 1979-80 to 1981-82
Written language (total)	76.6	+1.8
Paragraphs	71.3	+1.7
Topic sentences	70.1	+1.7
Details and sequence	72.5	+1.6
Sentence recognition	80.5	+2.1
Statements and questions	76.1	+2.0
Complete sentences	81.7	+2.2
Supplying subjects	80.8	+2.0
Supplying verbs	82.5	+2.2
Language choices	68.6	+2.5
Sensory words	74.1	+2.0
Specific words	63.1	+2.9

■ Percent correct score, 1979-80
□ Percent correct score, 1981-82

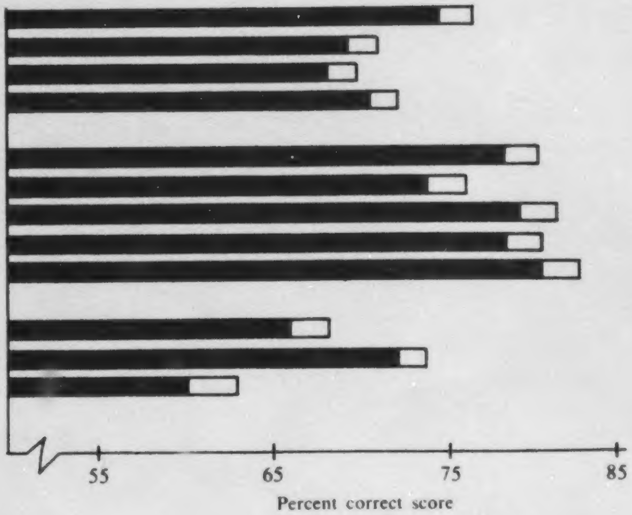


Fig. 16. Percent correct scores of California third grade students for the writing process skills within written language, 1981-82, and changes in scores, 1979-80 to 1981-82

The members of the English Language Assessment Advisory Committee were extremely pleased to see the gains in all writing process skills. The committee members were especially gratified to observe the sizable increases in the language choices areas, particularly specific words (with a 2.9 percent correct cumulative increase), since these skill areas have been designated by the committee in previous years for special instructional attention. They observed, however, that of the various writing process skills, the specific words element of language choices continues to be by far the most difficult area for third graders. Given this fact, the committee agreed that continuing instructional efforts are needed at the intermediate levels to help children develop a firm grasp of levels of abstraction in language that can help them learn to make better use of detail in their writing.

The committee observed that after language choices, the area of greatest difficulty for third graders was that of topic sentences within pragraphs (70.1 percent correct.) These questions require third graders to select a sentence that provides a topic for a partial paragraph presented in the item stem. The relatively weak third grade showing in this area led the committee to stress that primary grade teachers need to deal consistently with whole units of thought as much as possible and avoid fragmenting and isolating language elements from meaningful context.

The members of the advisory committee were very pleased with the high scores and gains (80.5 percent correct; 2.1 percent gain) in sentence recognition, an area which the committtee has insisted is of central importance in the writing process. (The committee's view of the importance of sentence recognition is reflected by the fact that the grade three written language test contains more sentence recognition items than any other type of question.)

The areas that the committee found to be of least and greatest difficulty are listed in Chart 1 for both supporting and writing process skills. The committee's instructional recommendations follow the chart.

Chart 1
Areas of Weakest and Strongest Achievement in Grade Three
Written Language for Supporting Skills and Writing Process Skills

	Skill areas showing strongest performance	Skill areas showing weakest performance
Supporting Skills	Capitalization Persons Places Days/months Spelling predictables Punctuation with periods and question marks Contractions	Spelling words with suffixes Irregular noun plurals Punctuation with commas
Writing Process Skills	Supplying verbs to form complete sentences Supply subjects to form complete sentences	Selecting specific words for precise language choices Supplying paragraphs with topic sentences.

ENGLISH LANGUAGE ASSESSMENT ADVISORY COMMITTEE'S INSTRUCTIONAL RECOMMENDATIONS FOR GRADE THREE

1. Primary grade teachers should nurture fluency in students' own writing; a concern for correctness in language should not interfere with the major objective of nurturing this fluency.

2. More emphasis is needed in the area of language choices, which would offer primary grade children numerous opportunities to learn to use specific and sensory detail in their writing.

3. Efforts to develop sentence and paragraph sense in primary grade children should be continued through a wide variety of oral and written activities in which active use of language is central.

4. The focus of instruction should be whole units of thought rather than fragmented pieces of language isolated from context.

Written Language Test Results for Grade Six

Test Scope and Foundations

In 1981-82, a new sixth grade test, the Survey of Basic Skills: Grade 6, was administered for the first time. The written language section of the Survey of Basic Skills: Grade 6 contains questions from nine skill areas that are divided into two main categories. The first is "writing process skills," which deals primarily with matters of judgment in effective writing. The skills included in this category are (1) judging student writing; (2) paragraphs; (3) sentence combining; (4) sentence recognition; and (5) language choices. The other category, "supporting skills," is also a necessary part of writing instruction, and includes the following skills: (6) standard English usage; (7) word forms; (8) capitalization and punctuation; and (9) spelling. These skills reflect the goals and objectives stated in the English Language Framework for California Public Schools: Kindergarten Through Grade Twelve and the Handbook for Planning an Effective Writing Program as well as the major written language skills covered in state-adopted language textbooks commonly used in California's sixth grade classrooms.

Decisions concerning relative emphasis and breadth of content for each of the nine skill areas were made by the English Language Assessment Advisory Committee, which is composed of language arts experts representing a cross section of instructional levels and educational institutions across the state.

The committee members considered the following sources of information during the test development process:

1. Content analyses of commonly used sixth grade language textbooks adopted by the State Board of Education.

2. Field reviews of skill area compilations in which teachers and curriculum specialists indicated the degree of emphasis they assigned to each skill area.

3. Reviews in which teachers judged each language item as to the degree of instructional emphasis placed on that particular skill and whether the item should be retained, modified, or omitted.

The relative degree of emphasis assigned to each of the written language skill areas in the Survey is presented graphically in Figure 17. For an illustrated description of all reading skill areas and underlying rationale, see Survey of Basic Skills: Grade 6, Rationale and Content.

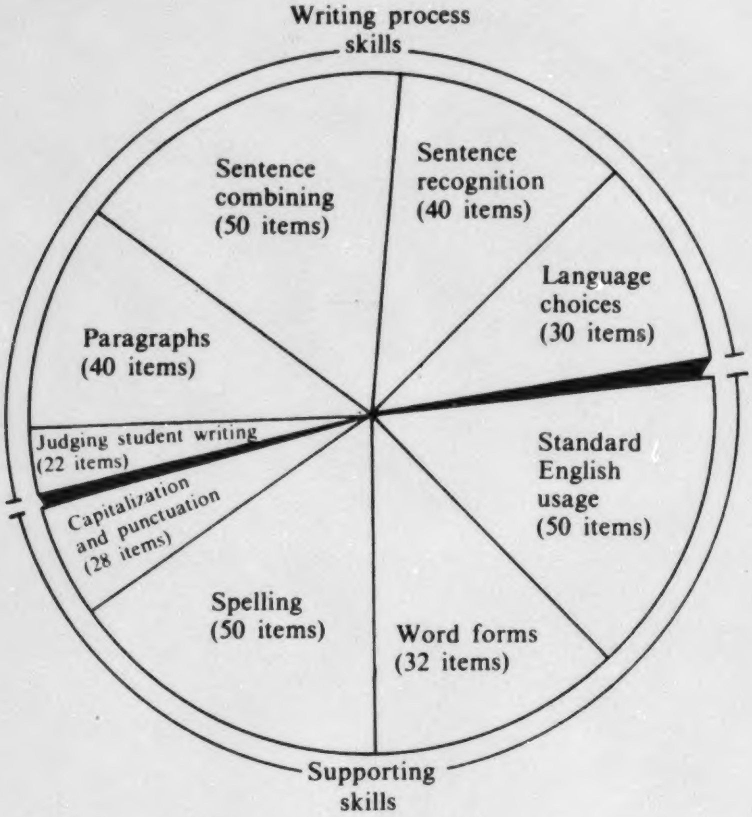


Fig. 17. Number of questions, by skill area, in the written language section of the *Survey of Basic Skills: Grade 6*

Written Language Results for Grade Six

The Survey of Basic Skills: Grade 6 was administered for the first time in 1981-82. The results of the written language section of this test are shown in Table 6, and the major skills are displayed graphically in Figure 18.

65

Written Language Results, Grade Six

Table 6

Written Language Scores of California Sixth Grade Students on the Survey of Basic Skills: Grade 6, 1981-82

Skill area	No. of questions	Mean score
WRITTEN LANGUAGE, TOTAL	342	73.3
Writing Process Skills	182	72.6
Judging student writing	22	71.4
Paragraphs	40	76.1
Topic sentences	10	74.2
Details and sequence	10	77.0
Outlines for organization	10	71.7
Consistency of verb and pronoun usage	10	81.6
Sentence combining	50	66.8
Simple sentences with modification	13	52.0
Compound sentences and sentence parts	13	66.0
Complex sentences	14	68.9
Conjunctions	10	84.3
Sentence recognition	40	75.2
Supplying subjects	13	90.5
Supplying verbs	13	84.7
Forming complete sentences	14	52.1
Language choices	30	75.0
Sensory words	10	75.8
Specific words and sentences	10	67.1
Achieving tone through word choices	10	82.0
Supporting Skills	160	74.1
Standard English usage	50	78.2
Irregular verbs	10	77.5
Pronouns	10	66.7
Subject-verb agreement	10	72.4
Noun determiners	10	91.2
Double negatives	10	83.0
Word forms	32	74.6
Suffixes	10	79.6
Irregular noun plurals	10	71.3
Contractions	12	73.2
Spelling	50	71.2
Predictable words	15	73.2
Words with suffixes	15	64.4
Demons	10	76.8
Homophones	10	72.9
Capitalization and punctuation	28	71.5
Capitalization	14	70.6
Punctuation	14	72.4

Written Language Results, Grade Six

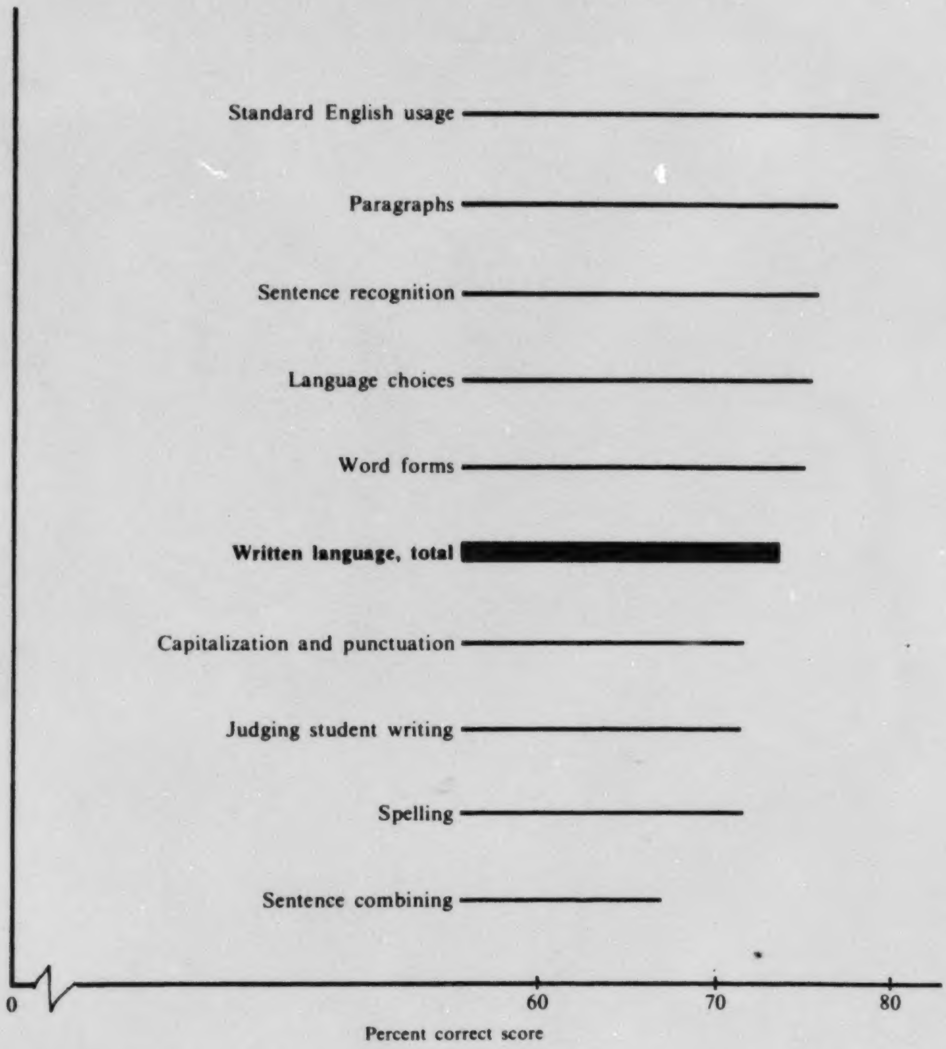


Fig. 18. Percent correct scores of California sixth grade students for the major skill areas in written language, 1981-82

The following observations are evident from the data in Figure 6.

- The easiest major skill area was that of standard English usage (78.2 percent correct), while the most difficult major skill area was sentence combining (66.8 percent correct).

- Among subskill elements, the easiest areas were noun determiners (91.2 percent correct) and supplying subjects (90.5 percent correct).

- The most difficult areas among all the subskills were those of simple sentences with modification (52.0 percent correct) and forming complete sentences (52.1 percent correct).

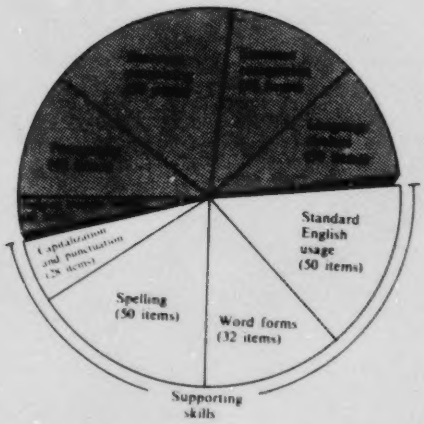
Interpretation of Skill Area Results, Grade Six

The members of the English Language Assessment Advisory Committee, a panel of outstanding California educators with recognized expertise in language arts instruction and assessment, analyzed, interpreted, and evaluated the 1981-82 written language results for grade six. In this process, they reviewed the scores in the written language skill areas in light of the philosophy underlying the CAP written language tests. This philosophy is stated generally in the English Language Framework and more specifically in Survey of Basic Skills: Grade 6, Rationale and Content.

The following discussion focuses on the two broad clusters of skills assessed on the Survey of Basic Skills: Grade 6: (1) supporting skills and (2) writing process skills.

Supporting skills...

"Supporting skills" is the term chosen by the committee for those areas of the test that deal with matters of correctness. These skills, which include standard usage, word forms, spelling, and capitalization and punctuation, are briefly described and illustrated below.



- Standard English usage items assess the ability to use verbs and pronouns, to avoid double negatives, and to achieve agreement in number between subject and verb, and between a noun determiner (for example, "this," "these," "that") and the noun it modifies.
- Word form items assess the ability to form words with suffixes, irregular noun plurals (for example, "geese," "children," and "shelves"), and contractions.
- Punctuation and capitalization items require pupils to use periods, question marks, commas, apostrophes, and quotation marks correctly, and to select words (such as names, places and holidays) which are correctly capitalized.
- Spelling items assess the ability to spell predictable words (that is, words that can be taught in word families or groups following similar, generalizable patterns); words with predictably-spelled suffixes; demons; and homophones (such as "to," "too," and "two").

Written Language Results, Grade Six

Illustrative items

The teacher says: Fill in the bubble next to the one that completes the sentence correctly.

The cats _____ together.

○ was playing
○ plays
○ were playing
○ is playing

Standard English usage

The teacher says: Fill in the bubble next to the one which completes the sentence correctly.

Our high school band includes _______ trumpets, and drums.

○ clarinets
○ clarinets;
○ clarinets,
○ clarinets.

Punctuation and capitalization

The teacher says: Fill in the bubble next to the one which completes the sentence correctly.

His _____ was greatly appreciated.

○ kindly
○ kindness
○ kindest

Word Forms

The teacher says: On the dotted line, write out the word with the missing letters. Now choose the letter or letters needed to spell the word correctly, and fill in the bubble next to the one you choose.

We will go swim____ every day.

○ ing
○ ming
○ eing
○ in

....

Spelling

The scores for the supporting skills within the sixth grade written language test are shown numerically and graphically in Figure 19.

Written Language Results, Grade Six

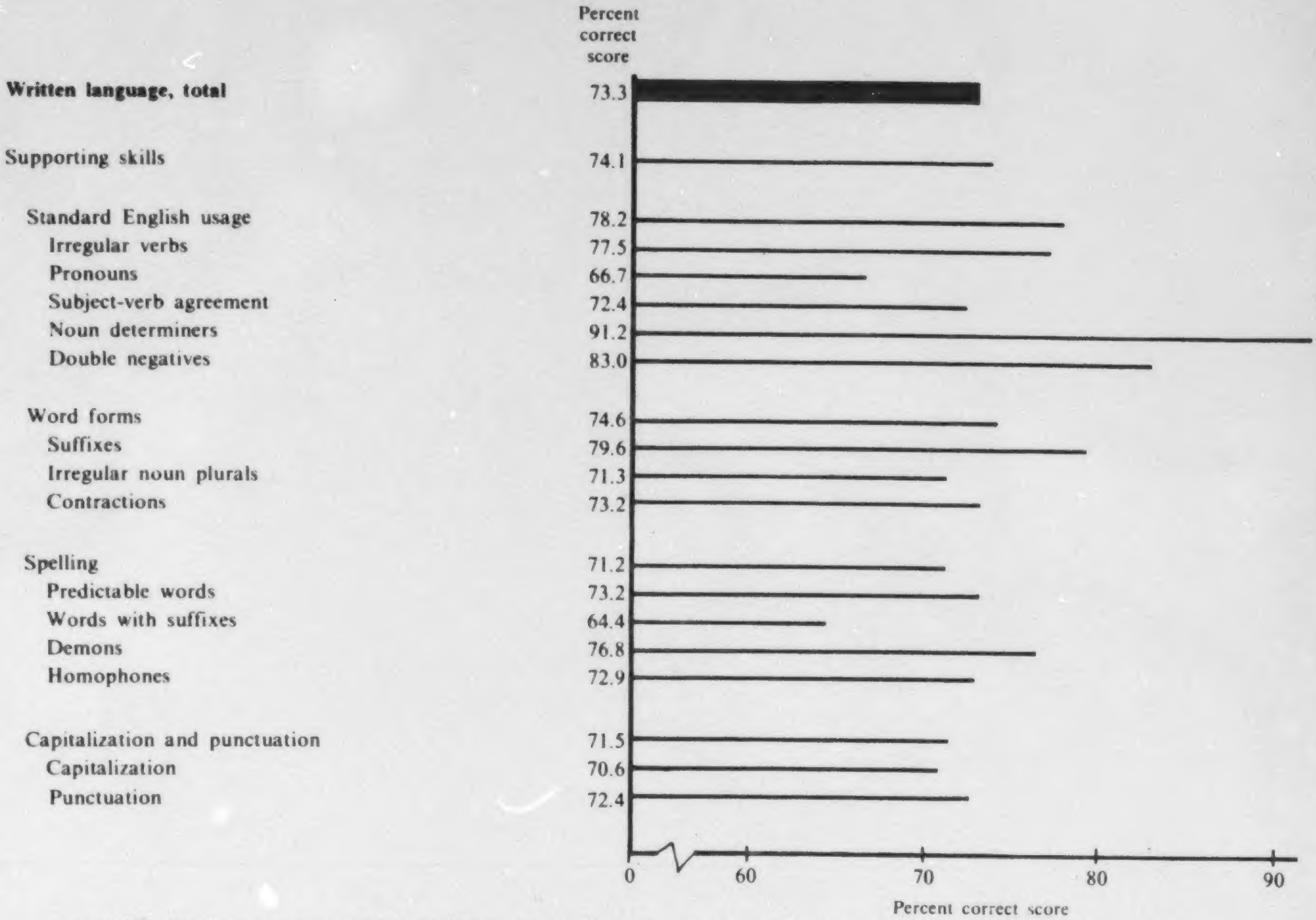
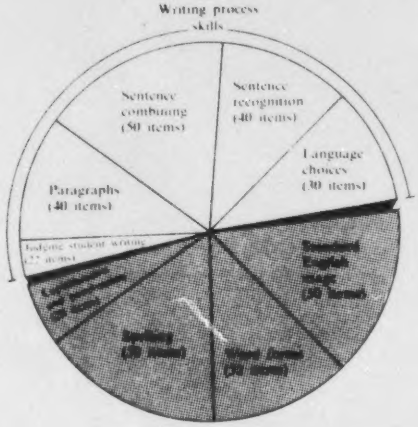


Fig. 19. Percent correct scores of California sixth grade students for the supporting skills within written language, 1981-82

The members of the English Language Assessment Advisory Committee studied these results and observed that most of the scores for the written language supporting skills tended to cluster between 70 and 80 percent correct. Four subskills proved to be exceptions to this pattern, two of which were easier and two of which were harder for students than the other skills. The cluster of noun determiner items (using words like "this," "these," and "that" correctly) was by far the easiest written language subskill on the test, with an average score of 91.2 percent correct. On similar questions on the third grade test, students registered a relatively high score also (78.9 percent correct), but the sixth grade data suggest that nearly complete mastery has occurred in the use of noun determiners by the end of sixth grade. The second easiest supporting skill score was that for the area of double negatives. While some items were more difficult than others (especially constructions using words like "hardly," "nobody," and "no one"), 60 to 90 percent of the students demonstrated the ability to avoid double negatives in most cases. The lowest scores among the supporting subskills were for spelling words with suffixes (64.4 percent correct) and using pronouns (66.7 percent correct). The members of the committee were not surprised at the score registered for spelling words with suffixes, given the difficulty this troublesome skill presents to students at all levels. Nor were they surprised at the relatively low score for the pronoun skill area, in which scores typically fluctuate greatly from item to item at the elementary school level. The committee members believe that the inconsistent performance in this skill area at grades three and six is the result of students' not being mature enough to determine correct pronoun usage from grammatical rules; instead, they appear to be relying on the sound of language in making their choices and are "overcorrecting" in some cases (for example, in such constructions as "Show it to Pat and I").

Writing process skills...

The writing process skills are more central than supporting skills to the process of writing and deal more with choices, decisions, and matters of judgment than with matters of correctness. Five skill areas on the Survey of Basic Skills: Grade 6 deal with writing process skills: judging student writing, paragraphs, sentence combining, sentence recognition, and language choices. Each of these skill areas is described and illustrated below.



- Judging student writing items assess the ability to identify from corrected samples of student writing particular *strengths*, such as: recognizing effective use of detail; unified paragraphs in which all the sentences support the topic sentence; letters which successfully communicate a message; and imaginative ideas, as well as *weaknesses*, such as: recognizing repetitious paragraphs; paragraphs which drift away from the topic; essays with many short, choppy sentences; persuasive letters which fail to present convincing arguments; and essays which lack a strong introduction or conclusion.

- Paragraph items assess the ability to choose a sentence for a blank in a paragraph which will make sense in the context of the paragraph; these items include topic sentences, relevant details, necessary sequential elements, details selected according to an outline, and verbs or pronouns grammatically consistent with the rest of the paragraph.
- Sentence combining items assess the ability to form effective sentences from a set of simple sentences. The effective sentences presented as the correct answers include (1) simple sentences with modification and interrupters (such as appositives), (2) compound sentences or sentences with compound parts, and (3) complex sentences. Another cluster of items assesses the ability to use conjunctions by (1) requiring the choice of a sentence which follows logically from another given statement and conjunction (e.g., I like cake, but ________________.), and (2) requiring the choice of a conjunction in a sentence (e.g., I like cake, ____ I don't like pie.).
- Sentence recognition items test the ability to form a complete sentence by supplying a needed subject or verb, and to discriminate between complete sentences, run-ons, and fragments.
- Language choice items assess the ability to select effective or appropriate words for particular purposes, including the following: (1) specific words or sentences which will provide the most detailed or exact information (for example, the word "apple" would be identified as more exact than "fruit" or "food"); (2) words which appeal to a given sense (for example, a word such as "buzzing" or "screeching" would be associated with the sense of sound); and (3) words which will achieve a particular tone or feeling (for example, "stingy" is associated with a more negative feeling than "thrifty").

Written Language Results, Grade Six

Illustrative questions

Read the student letter, and answer the question below.

Dear Mr. Vega,

I think the tidal pools would be a fun place to go for the fifth graders. It would be very interesting and fun. Please consider this request carefully,

Yours truly,
Pat Jones

Suppose your friend just wrote this letter. What advice would help her make it more convincing to the principal?

o Indent "Dear Mr. Vega."
o Add Mr. Vega's address in the upper right-hand corner of the letter.
o Mention the dangers of going to the tidal pools.
o Add examples of what could be learned by going.

Judging student writing

The following outline was used in writing the paragraph below it. Choose the sentence needed to complete the paragraph according to the outline.

I. Athletes don't get fat
  A. Example--tennis players
  B. Other examples--gymnasts and wrestlers
  C. Conclusion--strict diets

Most successful athletes don't allow themselves to become fat, because extra weight slows them down. ____________________. If they are ten pounds overweight, they may be slowed down by ten percent. Gymnasts and wrestlers must also be careful not to increase their body weight in order to compete successfully. Athletes usually maintain rather strict diets that keep their weight down.

o There are many sports which I enjoy watching.
o Tennis players, for example, have to move with lightning speed.
o You can play tennis at any age.
o Staying on a diet is difficult.

Paragraphs

The teacher says: Choose the one below which combines the numbered sentences in the best way.

1. Roller skating is a sport.
2. Roller skating is challenging.
3. Roller skating is growing in popularity.
4. Roller skating is played indoors and out.

o Roller skating is a sport, and it is growing in popularity, and it is played indoors and out, and it is challenging.
o Roller skating, a challenging sport growing in popularity, is played indoors and out.
o A challenging sport, roller skating, it is played indoors and out and is growing in popularity.

Sentence combining

The teacher says: Choose the one which will form one or more complete sentences.

We go camping to get away from _____ ____________________.

o crowds, we enjoy the peace and quiet.
o crowds. To enjoy the peace and quiet.
o crowds. We enjoy the peace and quiet.
o crowds. Enjoying the peace and quiet.

Sentence recognition

Select the one which would give a reporter the most detailed information about what Tom and Sarah saw.

Sarah and Tom stopped suddenly. On the street in front of them they saw ______________________________.

o some space ships with funny-looking people in them looking out the window
o three saucer-shaped ships with green, yellow, and orange tiny creatures frowning at the blue sky
o three large ships with some people in them who were just sitting there
o you know, big ships, very funny-looking guys and some other stuff

Language choices

Written Language Results, Grade Six

The percent correct scores for the writing process skills within the Survey of Basic Skills: Grade 6 are shown in Figure 20.

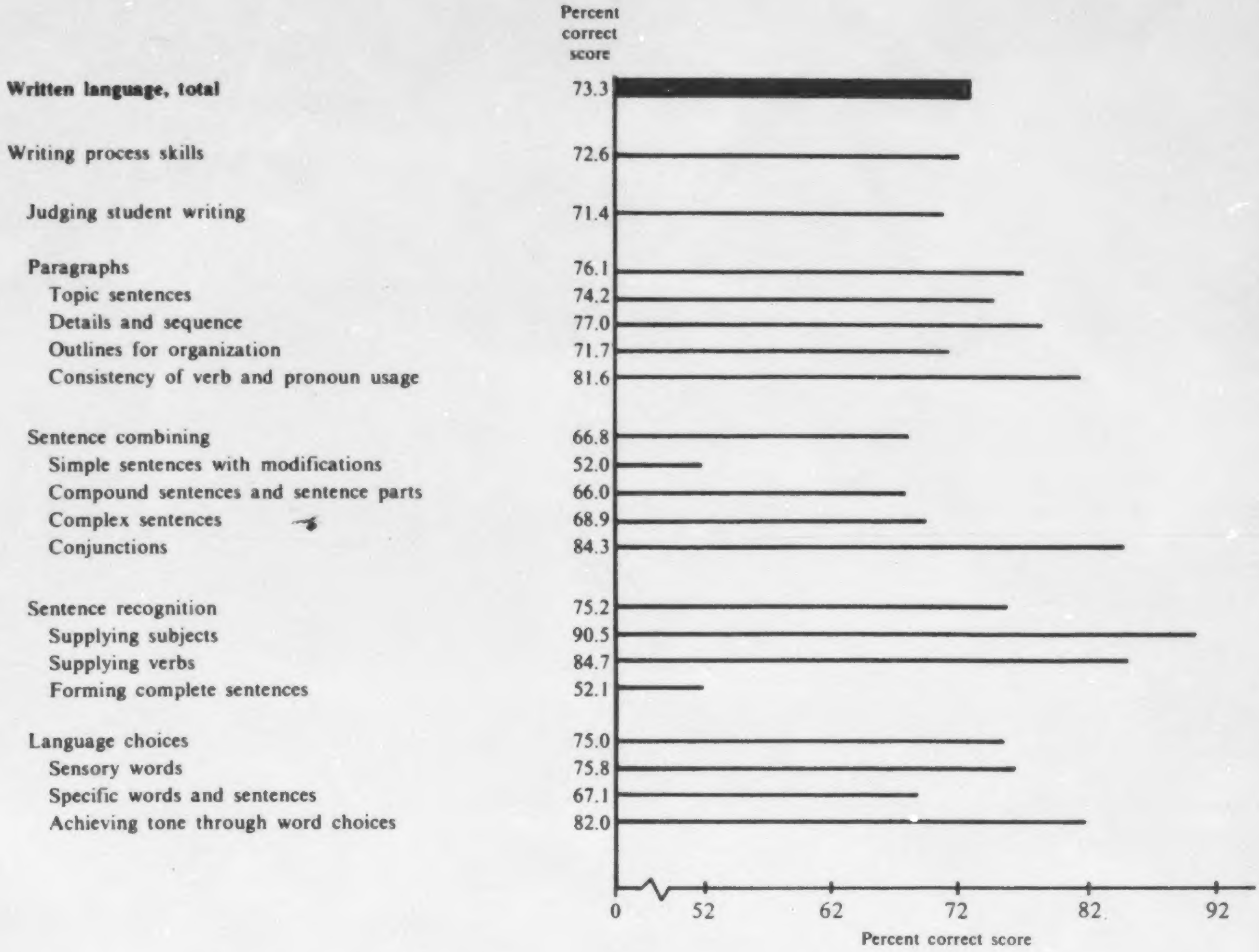


Fig. 20. Percent correct scores of California sixth grade students for the writing process skills within written language, 1981-82

Written Language Results, Grade Six

The members of the English Language Assessment Advisory Committee were pleased with the scores for most of the writing process skill areas. They observed that, as with the third graders, supplying subjects and supplying verbs to form complete sentences were the easiest writing process skills for sixth graders. They also noted with pleasure the high scores on items requiring students to use conjunctions appropriately. The writing process skills that presented the greatest degrees of difficulty for sixth graders were in the areas of (1) sentence combining; (2) sentence recognition; and (3) language choices.

The sentence combining exercises require students to select the most effective way to combine several numbered sentences presented in the item stem. The correct answer is typically a simple sentence with an appositive, a compound, or complex sentence. The members of the committee observed that the syntax of these items tends to be too complex for most sixth graders but that as native readers of English, most should be able to determine the correct choice by eliminating the exceedingly awkward distractors. The committee concluded that the weak sixth grade showing in this area underscores the need for continuing work with sentence combining exercises in junior high and high school.

The second area of greatest difficulty, forming complete sentences, is another skill that is introduced in the sixth grade but that involves considerable experience at the upper grade levels before mastery can be expected. While sixth graders demonstrated understanding of the need for a subject and verb in most sentences, as evidenced by the high scores in the other sentence recognition subskills, they are still displaying a great deal of confusion when required to discriminate between complete sentences, sentence fragments, and run-ons. This pattern was consistent with the expectations of the committee, given the comparative difficulty of the two kinds of sentence recognition skills. Again, the committee members concluded that students' poor performance underscores a need at the junior high level for continuing writing experience and instruction that will help students develop a more mature sense of complete sentence structure.

In the area of language choices, the subskill showing the weakest performance was the cluster of items requiring students to select the most detailed information for a given audience. Students at both grades three and six continue to exhibit considerable confusion when dealing with levels of abstraction (choices between vague, general statements and more specific ones) and the use of detailed information needed by a particular audience. The advisory committee has consistently stressed the importance of this skill area because fundamental to the writing process is an understanding of the information needs of a particular audience. Furthermore, research has shown that vagueness and generality continue to lessen the quality of student writing at all grade levels.

The areas showing the weakest and strongest achievement in grade six are presented in Chart 2 for both supporting and writing process skills. The committee's instructional recommendations for grade six follow Chart 2.

Chart 2

Areas of Weakest and Strongest Achievement in Grade Six Written Language for Supporting Skills and Writing Process Skills

	Skill areas showing strongest performance	Skill areas showing weakest performance
Supporting Skills	Using noun determiners Avoiding double negatives	Spelling words with suffixes Using pronouns
Writing Process Skills	Supplying subjects to form complete sentences Supplying verbs to form complete sentences Using conjunctions	Sentence combining Forming complete sentences (and avoiding fragments and run-ons) Using specific words and sentences to provide sufficient information and detail for a given audience

English Language Assessment Advisory Committee's Instructional Recommendations for Grade Six

1. Writing instruction should include more writing, more teaching of writing, a greater variety of writing assignments and adherence to the principles set forth in the Handbook for Planning an Effective Writing Program.

2. California Assessment Program results as well as assessments of students' writing should be used for analyzing strengths and weaknesses in students' writing and for setting goals.

3. Writing should be integrated with the teaching of reading in all content areas.

4. While students are engaged in the act of writing, only the process skills of writing should be emphasized. Later, during the act of editing, the supporting skills of writing should be emphasized as the need arises.

5. More emphasis is needed in the areas of language choices, vocabulary development, and sentence combining in the intermediate grades as well as throughout junior high school.

6. The focus of instruction should be whole units of thought rather than fragmented pieces of language isolated from context.

Written Expression Test Results for Grade Twelve

Test Scope

The written expression section of the Survey of Basic Skills: Grade 12 consists of 142 questions. The items were selected to assess the students' attainment of a wide variety of objectives compiled by the English Language Assessment Advisory Committee and published in Test Content Specifications for the Survey of Basic Skills: Written Expression and Spelling, Grades Six and Twelve (Sacramento: California State Department of Education, 1975). Both the objectives and the items used to assess achievement of the objectives fall into one of six major skill areas: word forms, language choices, sentence recognition, sentence manipulation, paragraphs, and capitalization and punctuation. The emphasis placed on each of the written expression skill areas in the Survey of Basic Skills: Grade 12 is shown in Figure 21.

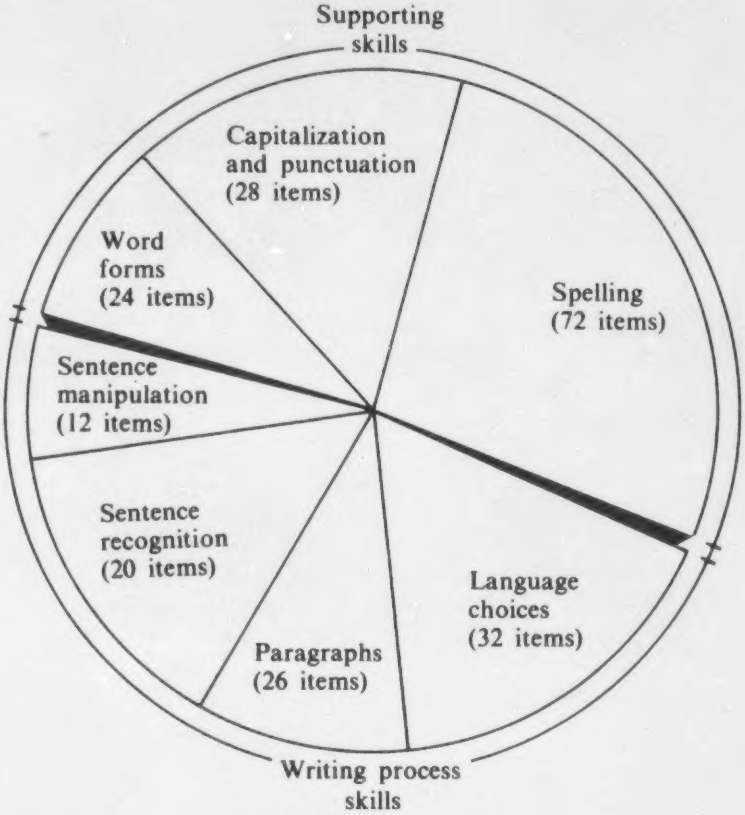


Fig. 21. Number of questions, by skill area, in the written expression section of the *Survey of Basic Skills: Grade 12*

Written Expression Scores for Grade Twelve

The results of twelfth grade performance on the total written expression test and in each of the skill areas for 1975-76 through 1981-82 are presented in Table 7. Year-to-year changes in overall performance and in skill performance are also shown in the table and are presented graphically in Figure 22.

Written Expression Results, Grade Twelve

Table 7

Written Expression Scores of California Twelfth Grade Students on the *Survey of Basic Skills: Grade 12*, 1975-76 Through 1981-82

Skill area	Number of questions	Average percent correct score, by year, in all skill areas							Change in average percent correct score, for all skill areas	
		1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1980-81 to 1981-82	1975-76 to 1981-82
WRITTEN EXPRESSION, TOTAL	142	62.3	61.9	62.1	62.4	62.4	63.1	63.2	+0.1	+0.9
Word forms	24	72.6	72.1	72.1	71.9	72.2	72.5	72.1	-0.4	-0.5
Language choices	32	66.9	66.7	66.6	66.6	66.3	66.7	66.9	+0.2	-0-
Sentence recognition	20	67.3	67.7	68.4	68.8	69.0	70.1	70.1	-0-	+2.8
Sentence manipulation	12	42.9	42.9	43.4	43.7	43.7	44.3	44.6	+0.3	+1.7
Paragraphs	26	59.9	59.1	59.3	59.7	59.7	60.2	60.5	+0.3	+0.6
Capitalization and punctuation	28	54.6	54.3	54.7	55.4	55.4	56.6	56.8	+0.2	+2.2
Spelling	72	68.0	67.9	68.4	68.4	68.8	69.0	69.5	+0.5	+1.5

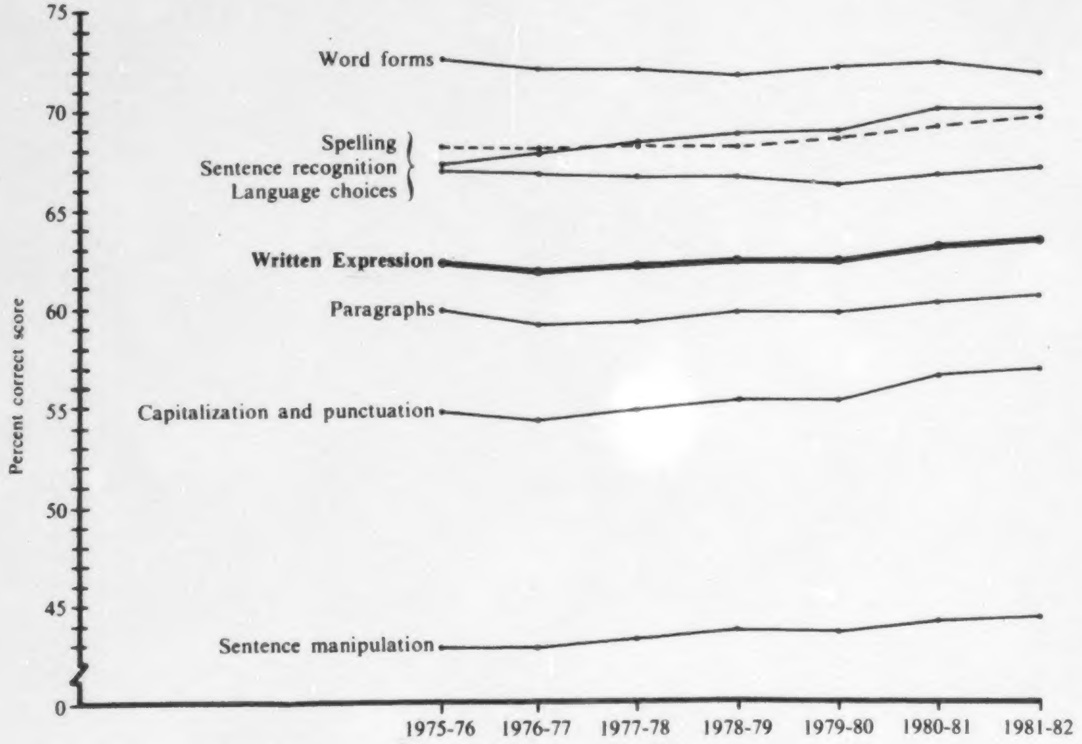


Fig. 22. Longitudinal trends of percent correct scores of California twelfth grade students for the skill areas in written expression, 1975-76 through 1981-82

Written Expression Results, Grade Twelve

The following observations are apparent from the data in Table 7.

- The overall twelfth grade written expression score increased from 63.1 percent correct in 1980-81 to 63.2 percent correct in 1981-82, a gain of 0.1 percent correct.

- From 1980-81 to 1981-82, gains were registered in five of the seven skill areas, with the largest increase occurring in spelling.

- No change was registered for the skill area of sentence recognition, while word forms showed a decline of 0.4 percent correct.

- In the last six years, from 1975-76 to 1981-82, the largest gains were made in the areas of sentence recognition (2.8 percent correct), capitalization and punctuation (2.2 percent correct), and sentence manipulation (1.7 percent correct). No overall change has been made in student performance in language choices since 1975-76 (despite increases the last two years), and the score for word forms has declined 0.5 percent correct since 1975-76.

Interpretation of Skill Area Results, Grade Twelve

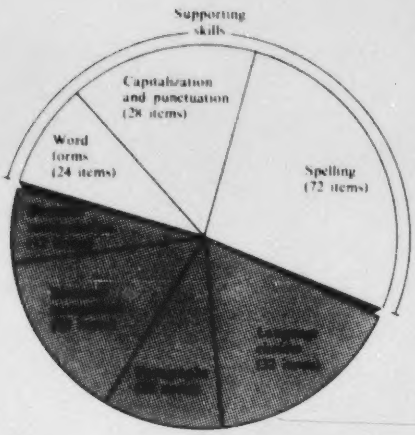
The members of the English Language Assessment Advisory Committee, a panel of distinguished California educators with recognized expertise in language arts instruction and assessment, analyzed, interpreted, and evaluated the 1981-82 written language results for grade twelve. In this process, they examined the changes in skill area performance in light of the Handbook for Planning an Effective Writing Program, which includes standards for assessing the quality of a school's writing program. The philosophy stated in the handbook is that writing should be a major component across the curriculum, with skills instruction in a supporting capacity. The following discussion addresses the two broad areas of skills assessed on the written language portion of the Survey of Basic Skills: Grade 12: (1) supporting skills; and (2) writing process skills.

Supporting skills...

"Supporting skills" is the term used by the committee for those areas of the test that deal with matters of correctness and mechanics. These skills, which include word forms, spelling, and capitalization and punctuation, are described and illustrated below.

Written Expression Results, Grade Twelve

Supporting skills



- Word form items assess the ability to select the appropriate inflectional suffix (-ed, -ing, -s, -ly, -er, -est) for a given sentence, discriminate between form class words (such as nouns and verbs) and structure words (such as prepositions), and demonstrate dictionary skills for a variety of purposes.
- Capitalization and punctuation items assess the ability to recognize capitalization and/or punctuation errors in sentences.
- Spelling items assess the ability to identify correctly spelled and incorrectly spelled words that are underlined in a given sentence.

Illustrative items

The dogs had ______ the long trek.

○ survival
○ survivors
○ surviving
○ survived

Word forms

Identify any capitalization or punctuation errors in the underlined parts of the following sentence.

The Hills, who have just returned
A

from lake Tahoe, are already planning
B

next winter's trip. No Error.
C D

○ A ○ B ○ C ○ D

Capitalization and punctuation

Fill in the oval next to "right" if the word is spelled correctly or next to "wrong" if the word is spelled incorrectly.

Carmen steped on my toes.

○ Right ○ Wrong

Spelling

Written Expression Results, Grade Twelve

The percent correct scores for 1981-82 and the total changes in percent correct from 1975-76 to 1981-82 are shown below for the supporting skills within written expression:

	Percent Correct	Total Change
Written expression (total)	63.2	+0.9
Word forms	72.1	-0.5
Spelling	69.5	+1.5
Capitalization and punctuation	56.8	+2.2

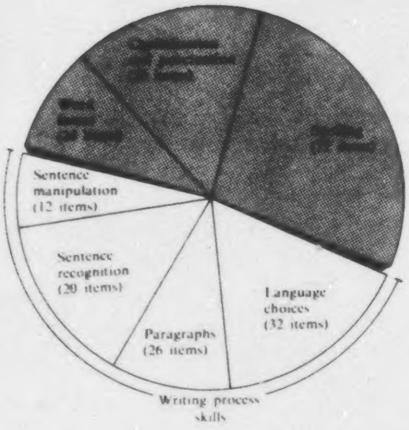
The members of the English Language Assessment Advisory Committee were pleased by the score increases for spelling and capitalization and punctuation; they were puzzled, however, by the decline in scores for word forms, which is the easiest skill area on the Survey of Basic Skills: Grade 12. The committee members speculated that this particular skill area is so basic that little instructional time is being devoted to it in most high schools. The members of the committee recommended that the following principle from the Handbook for Planning an Effective Writing Program (p. 18) be adhered to in teaching all writing skills:

> "Students can best develop their skill with the conventions of writing as the need for it arises in their work, rather than according to a fixed program. Writing itself, then, becomes the basis for determining which skills need to be learned by which students and at which time."

Writing Process Skills

The writing process skills tend to deal more with matters of judgment than with matters of correctness and tend to be more central to the process of writing. The writing process skills on the Survey of Basic Skills: Grade 12 include paragraphs, sentence manipulation, sentence recognition, and language choices. Each of these is described and illustrated below.

Written Expression Results, Grade Twelve



- Paragraph items assess the ability to identify irrelevant material in a paragraph, recognize inconsistent time development, select the logical sequence of a group of sentences, select the sentence which best summarizes the ideas presented in one or more related paragraphs, and identify transitional elements within a paragraph.

- Sentence manipulation items assess the ability to select the most economical, effective sentence, and recognize effective coordination and subordination within sentences.

- Sentence recognition items assess the ability to recognize complete sentences, sentence parts, sentence patterns, and the appropriate subject-verb relationship.

- Language choice items assess the ability to identify attitude-conveying words and phrases, differentiate between specific and general sets of words, and identify the audience of a prose passage.

Written Expression Results, Grade Twelve

Illustrative items

The seven sentences below are in a scrambled order. Some of them can be put together to make a single, unified paragraph. Before attempting to answer any questions, read all of the sentences carefully.

A 1 It probably received its name from its
2 copper-colored head which is triangular
3 in shape.
B 4 Like the rattlesnake, it is a member of
5 the pit viper family having a hollow or
6 pit between the eye and the nostril.
C 7 The copperhead was once the most common
8 and widely distributed of all venomous
9 snakes in the United States.
D 10 This may be the reason that Democrats in
11 the North who sympathized with the South
12 in the Civil War were called "copperheads,"
13 for they were suspected of treachery.
E 14 Unlike the rattlesnake, it has no rattles
15 and strikes without warning.
F 16 Augustus Thomas wrote a full length drama
17 that he called The Copperhead.
G 18 Today, however, it is most frequently
19 found in sparsely settled areas of the
20 South.

Which sentence most logically follows Sentence C?

○ Sentence A ○ Sentence E
○ Sentence B ○ Sentence G

Paragraphs

In the next item, Part I expresses ideas in choppy, repetitious sentences. Decide which sentence Part II expresses these same ideas MOST EFFECTIVELY.

I. There were some loose boards. They were laid on the railroad ties. They supplied a footing for the man. They also supplied a footing for his executioners.

II.
○ Laid on the railroad ties, the man stood on some loose boards which supplied a footing for him and his executioners.
○ Some loose boards laid on the railroad ties provided a footing for the man and his executioners.
○ Some loose boards laid on the ties supporting the rails provided a footing for the man and his executioners.
○ On the railroad ties were some loose boards, and they provided a footing for the man and his executioners.

Sentence manipulation

Identify the group of words which is incomplete or needs additional words to complete the meaning.

○ The barking dog in the driveway.
○ It is humid.
○ Peace continues.
○ There is the mail.

Sentence recognition

Dr. Henry J. Heimlich, ______________ at Jewish Hospital in Cincinnati, described the technique in the journal Emergency Medicine and invited physicians to try it in real emergencies.

Which of the following terms is most respectful in the context of the above sentence?

○ director of surgery
○ chief blade
○ practitioner
○ head doctor

Language choices

Written Expression Results, Grade Twelve

The percent correct scores for 1981-82 and the total changes in percent correct from 1975-76 to 1981-82 are shown below for the writing process skills within the *Survey of Basic Skills: Grade 12*.

	Percent Correct	Total Change
Written expression (total)	63.2	+0.9
Language choices	66.9	-0-
Sentence recognition	70.1	+2.8
Sentence manipulation	44.6	+1.7
Paragraphs	60.5	+0.6

The members of the English Language Assessment Advisory Committee were pleased to see the score increases in most of the writing process skills.

An examination of the trends in all skill area scores revealed that the skill areas showing the greatest total increases over the years are sentence recognition (2.8 percent correct) and capitalization and punctuation (2.2 percent correct). This pattern may reflect common instructional practices, especially in light of the current emphasis on the basic skills. That is, the greater improvement in capitalization and punctuation and sentence recognition in contrast to the smaller gains in language choices, sentence manipulation, and paragraphs may reflect the "back to basics" emphasis and concern for conventions and correctness. The members of the advisory committee concluded that while such skills as usage, word forms, and capitalization are important supporting skills, greater attention should be devoted to the writing process skills--language choices, sentence recognition, sentence manipulation, and paragraphs. The committee stressed that skills instruction should not be overemphasized at the expense of the total writing process and that skills should be taught as needed in support of writing.

The committee's instructional recommendations for grade twelve are presented on the following page.

English Language Assessment Advisory Committee's Instructional Recommendations for Grade Twelve

1. Writing instruction should include more writing, more teaching of writing, a greater variety of writing assignments, and adherence to the principles set forth in the Handbook for Planning an Effective Writing Program.

2. Writing should be integrated with the teaching of reading in all content areas.

3. While students are engaged in the act of writing, only the process skills of writing should be emphasized. Later, during the act of editing, the supporting skills of writing should be emphasized as the need arises.

4. Teachers should do more writing themselves, especially in the classroom with their students and on the topics they assign.

5. Various types of writing activities and events (such as writing celebrations, writing showcases, write-athons, writing fairs, and writing olympics) should be planned and conducted to emphasize the importance of writing and to provide out-of-classroom audiences for the students' writing.

6. California Assessment Program results as well as assessments of students' writing should be used for analyzing strengths and weaknesses in students' writing and for setting goals.

Written Expression Results, Grade Twelve

Number of English Courses Taken

In the 1978-79 Annual Report, data were presented on the number of English courses taken in high school by twelfth graders. At that time, 58 percent of the twelfth graders reported taking four or more years of English. In 1981, the University of California established four years of high school English as an entrance requirement for incoming freshmen.

In 1981-82, grade twelve students were again asked to report the number of English courses they would have completed from the beginning of ninth grade to the end of the twelfth.

The percents of students taking one, two, three, and four years of English and their corresponding written expression test scores are shown in Table 8 for 1978-79 and 1981-82.

Table 8

PERCENT OF TWELFTH GRADE STUDENTS AND THEIR WRITTEN EXPRESSION SCORES BY YEARS OF ENGLISH TAKEN, 1978-79 AND 1981-82

Years of English	Percent of students						Percent correct score					
	Total		Boys		Girls		Total		Boys		Girls	
	1978-79	1981-82	1978-79	1981-82	1978-79	1981-82	1978-79	1981-82	1978-79	1981-82	1978-79	1981-82
One	0.7	0.7	0.8	0.8	0.5	0.7	45.6	45.9	45.9	46.1	45.2	45.6
Two	5.0	3.3	5.4	3.8	4.5	2.8	53.5	50.7	52.6	50.2	54.8	51.5
Three	36.4	21.7	37.1	22.6	35.7	20.8	59.9	57.7	58.7	56.8	61.2	58.6
Four or more	58.0	72.4	56.7	70.7	59.3	74.2	65.0	65.9	63.9	64.9	66.1	66.8

The following conclusions are evident from the data in Table 8:

- Almost three-fourths (72.4 percent) of the twelfth graders in 1981-82 reported taking four or more years of English, an increase of 14.4 percent over California's high school seniors of 1978-79.
- Higher written expression scores were directly associated with the number of years of English students reported taking. For example, the highest scoring group, which obtained an average score of 65.9 percent correct, reported taking four or more years of English. It must be noted that these data fail to show the strength of a causal relationship, since superior students are more likely to take more years of English.
- As was true in 1978-79, a higher percentage of girls (74.2 percent) than boys (70.7 percent) reported taking four years or more of English, and girls (with an average score of 66.8 percent correct) continue to outscore boys (64.9 percent correct) on the written expression test.

Table 9 shows the percents of students taking one through four or more years of English, by the educational level of their parents.

Table 9

PERCENT OF TWELFTH GRADE STUDENTS AND THEIR WRITTEN EXPRESSION SCORES BY YEARS OF ENGLISH TAKEN AND PARENTAL EDUCATION, 1978-79 AND 1981-82

	No high school				High school				Some college				Four years				Advanced degree			
	1978-79		1981-82		1978-79		1981-82		1978-79		1981-82		1978-79		1981-82		1978-79		1981-82	
Number of years of English taken	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score	%	Score
1	1	35.0	2	42.1	1	47.3	1	44.4	1	48.2	1	51.2	1	45.7	1	49.5	1	59.5	1	51.5
2	8	45.6	6	45.8	7	53.1	5	50.0	4	57.1	3	54.0	3	54.6	2	53.8	3	61.6	1	56.8
3	40	51.1	30	51.3	43	56.8	28	56.3	38	62.5	23	59.7	31	63.5	16	60.9	27	66.0	12	62.0
4+	51	54.2	62	56.1	49	59.9	66	61.2	57	65.6	73	66.2	65	68.8	81	69.4	69	72.7	86	72.2
Total	51.9		53.6		57.9		58.9		63.9		64.1		66.4		67.4		70.5		70.5	

These data reveal the following:

- The tendency of twelfth graders to take four or more years of English is associated with the degree of parental education.
- Sizable increases in the percents of students taking four or more years of English since 1978-79 have occurred in all socioeconomic groupings (degree of parental education being considered an indicator of socioeconomic status). This fact suggests that there is no reason to believe that the increases are solely due to the 1981 University of California system requirement.

V. Mathematics Achievement for Grades Three, Six, and Twelve

Synopsis of Findings and Recommendations

In the spring of 1981, California's third-grade students were assessed for the second time in mathematics with the Survey of Basic Skills: Grade 3, and sixth-grade students were assessed for the sixth time with the Survey of Basic Skills: Grade 6. In December of 1980, the twelfth-grade students were tested for the sixth time with the Survey of Basic Skills: Grade 12. The following summary is based on the results of the administration of the surveys and the special equating studies conducted to compare the achievement of California students with that of students across the nation.

National Comparisons

On the Comprehensive Tests of Basic Skills, Form S, normed in 1973, the typical California third grade student now ranks at the 55th percentile, an improvement of three percentile points over the 1980-81 ranking. Also, on the Comprehensive Tests of Basic Skills, Form S, normed in 1973, the typical California sixth grade student now ranks at the 58th percentile, an improvement of two percentile points over the 1980-81 ranking. On the Iowa Tests of Educational Development, Form X-4, normed in 1962, the typical California twelfth grade student remains at the 46th percentile; however, on the same test, normed in 1978, the typical California student ranks at the 45th percentile, one point below last year.

In grade three, the performance of students has been improving since the introduction of the mathematics section in the third grade Survey. Over the three-year period from 1979-80 to 1981-82, the ranking increased from 51 to 55; the typical third grade student ranks five points above his or her national counterpart. In the sixth grade, the performance of students has been improving steadily one or two points each year since the introduction of the Survey in 1975-76. The typical sixth grade student now ranks eight points above his or her national counterpart. A typical twelfth grade student in California ranked at the 44th percentile in 1975-76, the year the Survey was introduced in the twelfth grade. The ranking declined to 43 in 1976-77 and remained steady through 1978-79. The ranking increased by one point in 1979-80 and by two points in 1980-81; no increase or decrease was recorded in 1981-82. The typical twelfth grade student stands four points below his or her national counterpart on the publisher's norms.

Longitudinal Survey Scores

Scores on the Survey are also expressed as percent correct scores. In grade three, the typical California student answered 76.0 percent of the questions correctly, an increase of 1.3 percent correct over the results of 1980-81. This increase in score was more than double the increase in score from 1979-80 to 1980-81. In grade six, the average student scored 62.6 percent correct. Since this year a completely revised version of the Survey was administered in the sixth grade, no longitudinal data on the new test are available. However, from the administration of the old Survey to a sample of California students, it was indicated that percent correct increased from 60.4 in 1980-81 to 61.6 this year. This year marked the greatest gains in mathematics scores of sixth graders since the inception of the sixth grade

Survey in 1975-76. In the twelfth grade, students gained 1.2 percent correct from 1979-80 to 1980-81; however, from 1980-81 to 1981-82, the scores of twelfth graders decreased by 0.3 percent correct.

Skill Area Strengths/Improvements

As in previous years, the members of the Mathematics Assessment Advisory Committee (see Appendix A) reviewed the results of the mathematics assessment for 1981-82. A summary of the detailed skill area strengths as judged by the committee members is presented in this chapter.

At each grade level students demonstrated a high level of mastery of computational skills. In grade three, almost all students demonstrated mastery of basic number facts; in grade six, almost all students performed simple computations involving addition, subtraction, and multiplication; and in grade twelve a great majority of students correctly performed basic operations on whole numbers.

The sixth and twelfth grade students had some difficulty in performing long division; however, the scores on long division questions are steadily improving. Another skill that showed a strong steady growth pattern was decimal computation.

As for noncomputational skills, students in grades three, six, and twelve did very well on recognition tasks and on tasks that students generally encounter outside the school. Such tasks include recognition of simple geometric figures; linear measurement such as with a ruler; measurement of time and temperature; and the reading of simple bar graphs.

Students in grades three, six, and twelve also showed better understanding of geometric terms and concepts, perhaps indicating some use of concrete manipulatives in the classrooms. The scores also showed good improvement in measurement concepts such as perimeter and area and conversion within a system of units. Scores in grades six and twelve also improved on questions related to the Pythagorean relationships.

Skill Area Weaknesses

The Mathematics Assessment Advisory Committee identified at each grade level the skill areas in which students were weak and that require more emphasis in the classrooms. Areas in need of improvement are listed separately for each grade level later in this chapter.

Generally, students at all grade levels were found to be weak in multiplication with numbers involving zeros, such as 10 or 100. In grades three and six, place value and subtraction with regrouping, especially involving an internal zero, were weak areas. In grades six and twelve, students had difficulty working with decimals because of their lack of understanding of place value. Third graders were also weak in solving word problems that involved multiplication of two or three numbers, and sixth and twelfth grade students were generally weak in solving two-step word problems.

Synopsis of Findings, Mathematics

In geometry and measurement, students were weak in areas that required forming a mental picture or performing estimation in the process of answering a question. In measurement, students at all grade levels were found to have more difficulty with the metric system than with the U.S. Customary system of measurement.

Differences in Mathematics Performance, by Sex

Differences in mathematics performance of girls and boys have been studied by the Mathematics Assessment Advisory Committee. The initial findings of the committee were first reported in 1979-80; the committee continues to explore why such differences exist.

Of the 13 skills involving computations, applications, and problem solving, girls surpassed boys on eight in the third grade, whereas of the 15 skills at grade six, girls surpassed boys on four. One surprising result found in this year's analysis of data is that although boys scored higher than girls in application problems, girls surpassed boys in questions on problem analysis. Such questions ask students to identify relevant information in a problem, to estimate the size of an answer, and to identify the appropriate mathematical model. The committee members felt that girls have developed better problem solving skills but that they are not applying these skills on application questions.

The Committee's Recommendations

The Mathematics Assessment Advisory Committee made general recommendations on the basis of its analysis of the mathematics results for grades three, six, and twelve. The committee's general recommendations are as follows:

- The use of manipulatives and models should be increased to facilitate student's understanding of place value concepts and to help them develop special visualization skills in two and three dimensions.

- At all grade levels, more instructional time should be spent on learning to recognize cues for selecting correct operations in application questions (as recommended in the addendum to the Mathematics Framework, 1982), rather than more drill and practice on computational skills. Although drill and practice on basic computational skills remain important, such techniques should be balanced with the development of skills in problem solving.

- Teachers and developers of instructional materials should strive to use those materials that help students at all ability levels to develop skills in problem analysis and modeling (as recommended in the addendum to the Mathematics Framework, 1982). This kind of instructional emphasis will not detract from the development of other skills but, in fact, should improve computation and application skills by giving students a clearer understanding of the mathematical processes involved in problem solving.

- Teachers should be provided with in-service training and with instructional materials that will aid them in helping students model and solve multiple-step problems. Teacher's guides should include practical examples or suggestions that will help teachers involve students in classroom activities that lead to opportunities for students to create and solve "real" multiple-step problems.

- It is important that teachers and curriculum personnel avoid imbalances in the curriculum. Some of the questions that might be asked in the planning of a strong mathematics curriculum are the following:

  - Are the needs of advanced students in algebra, geometry, trigonometry, and calculus being met, as well as the needs of students who require additional instruction in basic mathematics?

  - Are "end-of-the-book" topics systematically included and articulated across grade levels?

  - Are new textbooks being chosen that offer a variety of problem analysis techniques at all levels?

  - Is problem solving used for motivation and integration of mathematics into "daily-life mathematics" skills?

  - Is problem-solving instruction integrated with skill instruction rather than being delayed until complete student mastery is attained in computational skill?

  - Does instruction in measurement include actual situations in which all students participate actively in taking measurements?

  - Does the curriculum include the use of calculators and computers?

Mathematics Test Results for Grade Three

Test Scope

The Survey of Basic Skills: Grade 3 was developed to assess the levels of mathematics skills of third grade students in California. The 360 items on the Survey were designed to assess students' skills in the area of arithmetic (counting and place value, nature of numbers and properties, and operations), geometry, measurement, patterns and graphs, and problem analysis and models. In each area, with the exception of problem analysis and models, the test items include computational skills and knowledge of terminology as well as word problems. Figure 23 illustrates the emphasis placed on each skill area in the total test.

The emphasis on each skill area in the third grade Survey is consistent with the mathematics curriculum of most California schools and additionally reflects the "umbrella" concept of problem solving/applications emphasized

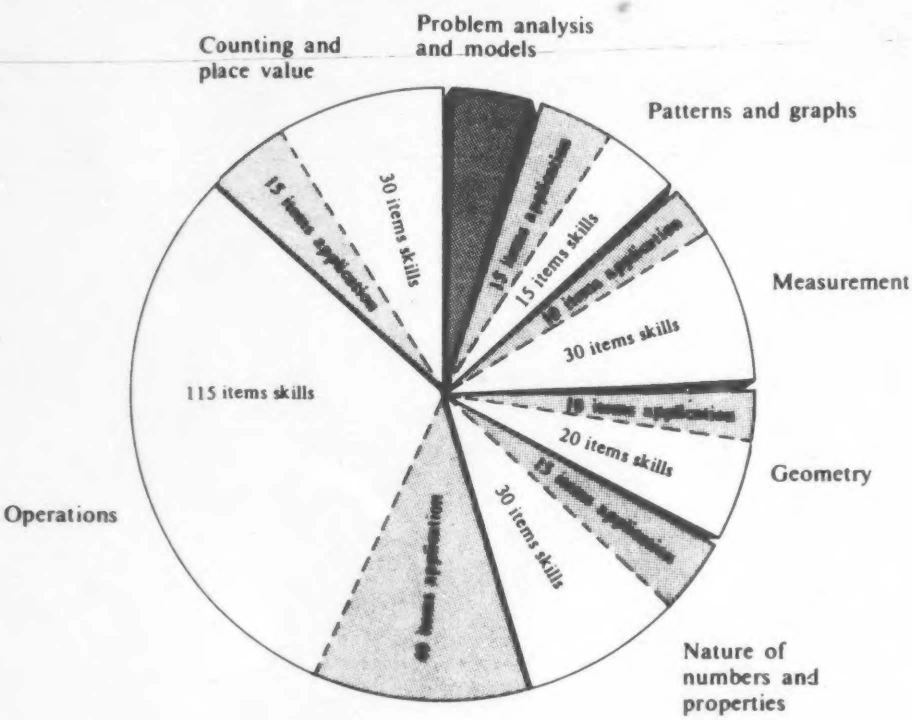


Fig. 23. Number of questions, by skill area, in the mathematics section of the *Survey of Basic Skills: Grade 3*

in the Mathematics Framework and the 1980 Addendum for California Public Schools: Kindergarten through Grade Twelve. In the new framework, the problem solving/applications, rather than being a separate strand, is now "positioned" to receive equal emphasis with each of the other strands of mathematics. Figure 24 shows the major content categories of mathematics recommended in the 1980 addendum including the problem solving/application skills. The third grade survey assesses all the skills proposed in the addendum at the third grade level except the skills on calculator/computer. A detailed description of the skills assessed in the third grade survey is given in Survey of Basic Skills: Grade 6--Rationale and Content.

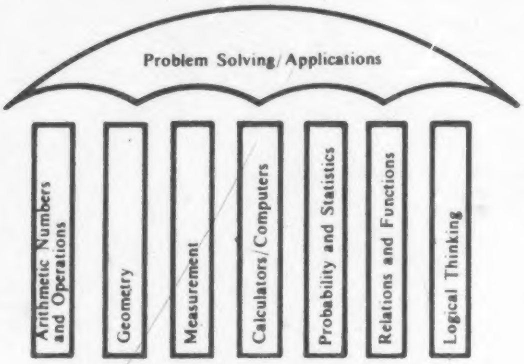

Problem Solving/Applications
Arithmetic Numbers and Operations
Geometry
Measurement
Calculators/Computers
Probability and Statistics
Relations and Functions
Logical Thinking

Fig. 24. Problem solving/applications, the umbrella for all strands in mathematics

Mathematics Results for Grade Three

The results of the third grade mathematics assessment for 1981-82 are shown in Table 10. This was the third year of the assessment in mathematics in grade three. Longitudinal comparisons are also given in Table 10 for the three-year period (1979-80 through 1981-82).

As shown in Table 10, the average California third grade student in 1981-82 correctly answered 76.4 percent of the questions in arithmetic skills; 76.6 percent in geometry; 74.6 percent in measurement; 75.9 percent in patterns and graphs; 71.2 percent in problem analysis and models; and 73.2 percent in problem solving/applications. Overall, the average third grade student correctly answered 76.0 percent of the mathematics questions.

The following conclusions can be drawn about the 1981-82 mathematics performance of California third grade students:

- The typical third grade student in California was able to answer over three-fourths of the test questions correctly.
- The average percent correct scores increased in all major subskill areas over those recorded in 1980-81.

Mathematics Results, Grade Three

Table 10

Mathematics Scores of California Third Grade Students and Changes in Mean Scores on the Survey of Basic Skills: Grade 3, 1979-80 through 1981-82

Skill area	Number of Questions	Mean score, by year			Change	
		1979-80	1980-81	1981-82	1979-80 to 1980-81	1980-81 to 1981-82
MATHEMATICS, TOTAL	360	74.1	74.7	76.0	+0.6	+1.3
Arithmetic	245	74.5	75.1	76.4	+0.6	+1.3
Counting and place value	45	79.3	79.9	81.3	+0.6	+1.4
Skills	30	79.7	80.3	81.9	+0.6	+1.6
Applications	15	78.5	79.1	80.3	+0.6	+1.2
Operations	155	72.7	73.3	74.8	+0.6	+1.5
Basic facts	25	85.9	86.3	87.5	+0.4	+1.2
Addition	30	82.6	83.4	84.7	+0.8	+1.3
Subtraction	30	69.9	71.0	73.1	+1.1	+2.1
Multiplication	30	63.7	64.5	66.7	+0.8	+2.2
Application	40	65.7	65.9	66.7	+0.2	+0.8
Basic facts	13	68.0	67.9	68.6	-0.1	+0.7
Addition/subtraction	15	75.0	76.0	77.4	+1.0	+1.4
Multiplication	12	51.4	51.2	51.2	-0.2	-0-
Nature of numbers and properties	45	75.8	76.3	77.4	+0.5	+1.1
Properties and relationships	15	76.0	76.4	77.5	+0.4	+1.1
Money and fractions	15	80.2	81.1	82.4	+0.9	+1.3
Applications	15	71.1	71.5	72.2	+0.4	+0.7
Geometry	30	74.9	75.1	76.6	+0.2	+1.5
Skills	20	76.3	76.3	77.7	-0-	+1.4
Applications	10	72.0	72.8	74.3	+0.8	+1.5
Measurement	40	73.4	74.0	74.6	+0.6	+0.6
Linear measures	15	69.7	70.6	72.0	+0.9	+1.4
Other measures	15	78.4	78.6	78.3	+0.2	-0.3
Applications	10	71.4	72.2	72.8	+0.8	+0.6
Patterns and graphs	30	73.8	74.6	75.9	+0.8	+1.3
Skills	15	63.5	64.1	65.7	+0.6	+1.6
Applications	15	84.1	85.0	86.2	+0.9	+1.2
Problem analysis and models	15	70.1	70.5	71.2	+0.4	+0.7
Problem solving/applications*	120	71.5	72.3	73.2	+0.8	+0.9

*Questions in this category are an aggregate of 105 application questions and 15 questions in problem analysis and models.

- The highest percent correct score was in operations using basic facts (87.5 percent correct), followed closely by applications with graphs (86.2 percent correct), addition operations (84.7 percent correct), and money and fraction problems (82.4 percent correct).

Summary of the Committee's Conclusions

The members of the Mathematics Assessment Advisory Committee reviewed the results of the third grade students by skill areas and by items within each skill area. This committee was instrumental in determining the scope of the assessment and in selecting the test questions. The names of the committee members appear in Appendix A. The committee members made the following general remarks about the performance of third grade students in California public schools.

- The committee members were unanimous in their praise of the performance of the third grade students, especially the pattern of growth in mathematics scores from 1979-80 through 1981-82.
- Teachers and students should be particularly commended for the strong performance and growth shown in mathematics scores over the three-year period.
- The strong performance in all major skill areas indicated to the committee members that a strong, comprehensive mathematics instructional program exists in kindergarten through grade three in California public schools.

The committee members also identified areas of strength or improvement and areas in need of improvement. The areas of strength included those skills in which students achieved at the committee's level of expectation. The areas of improvement included those skills in which student performance was at a level below the committee's expectation but on which the improved scores led the committee to believe that teachers are placing the desired emphasis. The areas in need of improvement included the skills that the committee members would like to have particularly emphasized in California classrooms.

Areas of Strength or Improvement

- Identifying ordinal positions (e.g., second, third, and so on) of familiar objects
- Counting by 1s, 2s, 5s, and 10s
- Identification of the place value of a given digit, especially zero, in a numeral
- Identification of the digit of a given place value in a numeral
- Recognition of numerical values of written numerals
- Addition, subtraction, multiplication, and division facts
- Word problems involving money
- Recognition of geometric terms and concepts

Areas of Strength or Improvement (cont.)

- Recognition of simple geometric figures
- Location of points on a coordinate grid
- Linear measure (nonstandard units)
- Linear measure (U.S. Customary units)
- Perimeter and area of geometric figures
- Measures of time (clock and calendar)
- Measures of temperature
- Reading of a bar graph
- Reading of a pictograph (especially those involving coins)
- Applications involving reading of graphs
- Recognition of a function rule
- Problem analysis

Areas in Need of Improvement

- Identification of odd or even numbers
- Multiplication involving numbers with zeros
- Subtraction of whole numbers, especially those with internal zeros or unseen zeros
- Multiplication of three whole numbers
- Word problems involving multiplication by 10 and 100
- Knowledge of the metric system
- Understanding of the concepts involved in determining the volume of an object
- Recognition of line segments
- Recognition of the diameter of a circle
- Linear measure (metric units)
- Estimation of measures of mass
- Applications involving measures of temperature
- Recognition of number patterns involving doubling
- Recognition of missing elements in geometric patterns
- Applications using basic facts
- Applications involving multiplication of whole numbers

The Committee's Recommendations

The members of the Mathematics Assessment Advisory Committee made the following recommendations for the improvement of mathematics skills in the third grade.

- The current emphasis in place value be continued because this concept is the key to the understanding of arithmetic operations, especially when students confront renaming in their mathematics curriculum.

- Students need more practice in reading mathematics problems for more complete comprehension.

- Instructional emphasis should be placed in giving students experiences to help them discriminate between standard units of length, volume, mass, and temperature and to know when to apply them in the measurement of some common object or quantity.

- In subtraction operations, the most common error made by students was subtracting the smaller digit from the larger digit regardless of the positions of the two digits in the problem. More instructional emphasis should be given to developing understanding of the subtraction algorithm, with renaming, through the use of manipulative materials, and to developing skills in its use.

- In application questions the most common error made by students was to add the numbers in the problem even though the operations called for were either subtraction or multiplication. The committee recommends that students be confronted with many sets of application problems that randomly involve all four of the basic operations and that greater instructional emphasis be given to the selection and use of the correct operation or operations.

- Instructional emphasis should be placed on relating multiplication skills to real-life applications from an early point in instruction.

- The current test results indicate that teachers now offer a comprehensive instructional program in mathematics in kindergarten through grade three. The committee strongly recommends that this broad instructional emphasis be continued to ensure steady improvement in all mathematical skills and concepts.

Some Examples and Ideas for Classroom Teachers

- Presenting computational problems in other than vertical format

- Introducing completed problems with portions missing to force students to think about arithmetic algorithms

- Asking students to discuss together the steps involved in solving a variety of problems

- Giving students completed problem sets, with errors hidden in the computation shown, and asking for identification and explanation of the errors

- Giving students experiences, oral and written, using "100 more than," "100 less than," and similar phrases for other decimal values

- Providing students with opportunities to identify incorrect answers and to tell why they are wrong, especially positional errors

- Demonstrating to students that subtraction allows renaming by 10s, 100s, etc., but addition of several numbers allows renaming by multiples of 10s, 100s, etc.

- Using place value boards and manipulatives to clarify for students the positional difference between addition, in which both numbers are represented, and subtraction, in which only the minuend is represented

- Using calculators to develop estimation, rounding, and place value skills

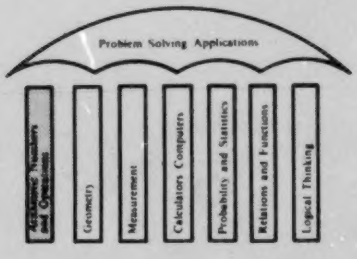
The Committee's Analysis of Skill Area Results

The members of the Mathematics Assessment Advisory Committee reviewed the results of the third grade students by skill area and by items within each skill area. The committee members judged the adequacy of student performance in light of the difficulty levels of the questions and the relative instructional emphasis of each skill in the typical classroom.

The results of the committee's analysis are summarized below in two categories--computational skills and problem solving/applications skills. The computational skills are described under two headings--"Arithmetic, Numbers, and Operations;" and "Geometry, Measurement, and Patterns and Graphs." In the following discussions only the areas of special strengths or weaknesses are described; no attempt is made to discuss each skill tested on the Survey. The purpose of the illustrative examples is to indicate the relative strength or weakness in the skills; hence, students' performance on illustrative items should not be taken as indicative of their performance in the entire skill area.

Arithmetic, Numbers, and Operations

The main skills included under this category are counting and place value, nature of numbers and properties, and operations. The subskills include the following: ordinal positions; counting by 1s, 2s, 5s, 10s, or 100s; reading and writing numbers; finding place values; using commutative and associative properties; multiplying a number by zero; using symbols for greater than, less than, and equal to; recognizing even and odd numbers; knowing basic facts; and performing operations of addition, subtraction, and multiplication on whole numbers.


Problem Solving Applications
Arithmetic, Numbers and Operations
Geometry
Measurement
Calculators Computers
Probability and Statistics
Relations and Functions
Logical Thinking

As shown in Table 10, third grade students continued to show improvement in the arithmetic skills of counting and place value, nature of numbers and properties, and operations. Not only was the total average percent correct for arithmetic higher in 1981-82, but also the score for every item increased.

Of the 190 computational items in arithmetic, the scores on three items remained the same and decreased only on three. Third grade students scored highest in basic facts (87.5 percent correct) and lowest in multiplication (66.7 percent correct); however, third grade students' greatest improvement (2.2 percent correct) from 1980-81 to 1981-82 was in multiplication.

In counting and place value skills, the committee felt that students have a good understanding of the concepts in general. On items that directly test understanding of place value, such as pictorial representation, expanded notation, and identification of digits in the ones, tens, and hundreds place, students showed good improvement. However, the committee members expressed a need for stronger reinforcement of skills in place value for all students at this grade level, because this concept is the key to understanding arithmetic operations, especially renaming as students progress in their mathematics curricula. The following example illustrates that 18 percent of the students were unable to identify the place value of the numbers 345:

345 =

13 ○ 3 + 4 + 5
3 ○ 400 + 30 + 5
2 ○ 400 + 50 + 3
82 ● 300 + 40 + 5

The committee members also found evidence that place value concept continued to be a weakness for some students at the sixth grade level (see the place value section for grade six).

In operations, the committee members observed that students appear to understand both the horizontal and vertical forms of addition, subtraction, and multiplication facts. Also, they felt that division facts are being taught and learned by the end of the third grade.

In operations skills, the committee members recognized that, although addition and subtraction skills are considered to be at the mastery level, multiplication is considered to be at the developmental level. Thus, the committee members felt that good instruction is being provided in computational skills and that student learning is adequate.

Mathematics Results, Grade Three

The committee members noted certain frequent errors by students in the computational skills. For example, in the following addition problem, 13 percent of the students selected 723, which is arrived at by juxtaposition of the numbers instead of renaming.

$$\begin{array}{r} 5 \\ 39 \\ +49 \\ \hline \end{array}$$

13	○	73	Failure to rename from ones to tens and from tens to hundreds
15	○	83	
61	●	93	
11	○	723	Failure to rename from ones to hundreds

Also, nine percent selected 83, which is the result of renaming or "carrying" a ten instead of twenty or two tens. Perhaps these students confused addition renaming with subtraction renaming, which allows only tens to be "borrowed." In subtraction problems involving renaming, some students simply subtracted the smaller digit from the larger digit regardless of their position in the problem.

The following subtraction question appears on both the third grade and sixth grade tests. As can be seen from the students' responses, most sixth grade students have learned to avoid positional value mistakes.

$$\begin{array}{r} 210 \\ -\ 162 \\ \hline \end{array}$$

	Grade Three	Grade Six	Response Characteristics
○ 158	11	2	Failure to make hundreds and tens
○ 152	28	4	Positional value ignored
○ 58	10	5	Failure to rename tens or positional value ignored for tens
● 48	51	89	

The following example shows students' performance in a multiplication problem. The pattern of errors shows a lack of understanding of place value by a large number of students:

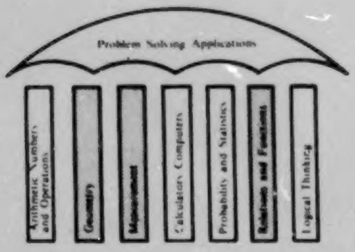
$$\begin{array}{r} 67 \\ \times\ 3 \\ \hline \end{array}$$

			Response Characteristics
13	○	81	Failure to rename from ones to tens and from tens to hundreds
15	○	181	Failure to rename from ones to tens
61	●	201	Correct answer
11	○	1821	Juxtaposition of products 18 and 21

On items involving multiplication by 10 or 100, the most common error made by students was adding rather than multiplying. The committee suspected that this error was due to the fact that some students have been told to add zeros to find the answer to multiplication problems involving 10 or 100.

Geometry, Measurement, and Patterns and Graphs

The questions in geometry cover skills in identifying basic geometrical shapes, parallel lines, line segments, right angles, diagonals of quadrilaterals, diameters of circles, and congruent figures. The questions in measurement deal with skills in measuring objects, converting units, finding appropriate units, and determining the perimeter and area of a polygon. The skills also include identifying correct time, order of days of the week, and months of the year; reading a calendar and thermometer; determining volume; and finding the heavier of two measures. The questions in patterns and graphs require skills in identifying the function rule, completing a function table, and identifying a geometric or number pattern.


Problem Solving Applications
Arithmetic Numbers and Operations
Geometry
Measurement
Calculators Computers
Probability and Statistics
Relations and Functions
Logical Thinking

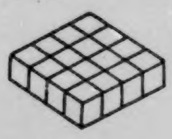
From Table 10, it is apparent that from 1980-81 to 1981-82, scores increased in all skills under geometry, measurement, and patterns and graphs except for the scores in "Other" (nonlinear) measures. The questions under the nonlinear measure require students to find the volume of pictured cubes and find the temperature in a pictured thermometer.

In geometry, the committee felt that students are doing an excellent job of recognizing and selecting common two-dimensional geometric figures. The committee, however, observed that students seem to have difficulty recognizing and/or identifying simple geometric components, such as parallel lines, diagonals, right angles, and diameters.

In measurement, the committee members noted that students continue to have greater difficulty with the metric system than with the U.S. Customary system of measurement. The members surmised that instruction in measurement skills is perhaps not too well developed at the third grade level; however, the scores do indicate that more and more instructional programs include metrics. In questions on counting the number of cubes (see the following example), the committee noted that most errors resulted from students' counting the visible faces of the cube rather than all the cubes:

How many cubes?

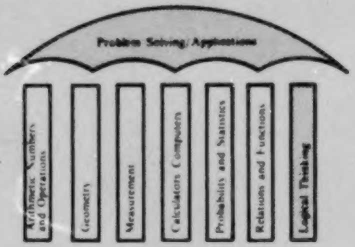
29 ○ 24
67 ● 16
1 ○ 9
3 ○ 4



With regard to scores on items on temperature, volume, or mass, the committee felt that the level of performance of third grade students is adequate. However, the committee members expressed concern over the decline in scores in this skill, the only skill on the entire test for which scores declined from 1980-81 to 1981-82. The committee recommended that increased instructional emphasis be given to teaching students to discriminate between standard units of length, volume, mass, and temperature and to know when to apply them in the measurement of some common object or quantity.

Problem Solving/Application

The third grade Survey includes word problems or application questions in all the skills of counting and place value, nature of numbers and properties, operations, geometry, measurement, and patterns and graphs. The application questions require the use of a skill, such as subtraction, to solve a word problem presented in daily life context. The test also includes questions in analysis and models (problem solving). In these questions the emphasis is not on finding correct numerical solution, rather the emphasis is on analyzing a word problem and finding given facts, missing information, or the question being asked. Some questions require students to match a picture model with a mathematical sentence or statement.


Problem Solving/Applications
Arithmetic Numbers and Operations
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Logical Thinking

Applications

In application questions involving basic facts and addition, the committee felt that students had good understanding of these skills. The committee noted some areas of difficulty, however. In application problems, students often chose an addition answer when subtraction or multiplication was the indicated operation. In a question on subtraction facts, 90.8 percent of the students knew that 15 - 8 = 7, but only 72.0 percent were able to use this fact correctly in a story problem. The answer found by adding together the numbers in the problem was selected by 16.2 percent of the students.

In the construction of the third grade Survey, 33 application items were designed to be paired with computation or concept items. These application items involve the same numbers and the same operations as the paired skill items. The average percent correct on the skills items in 1981-82 was 74.1, while the average percent correct on the paired application items was 69.1.

The two examples below show matched skills and application items involving multiplication. The percent of students who chose to add was four times as great in the application item as in the skill item.

$$\begin{array}{r} 23 \\ \times\ 3 \\ \hline \end{array}$$

3 ○ 20
9 ○ 26
4 ○ 68
84 ● 69

Brown School had 3 rooms.
Each room had 23 students.

How many students were at the school?

4 ○ 20
40 ○ 26
4 ○ 68
52 ● 69

Although the committee members noted growth in multiplication applications, they felt that scores in multiplication applications seriously lag the scores in other areas. The committee recommended that instructional emphasis be placed on relating multiplication skills to real-life applications as early as possible in the instructional program.

Problem Solving

The third grade Survey includes 15 questions in analysis and models. The average percent correct score in 1981-82 was 71.2 which was an increase of 0.7 percent correct over the 1980-81 score. The following question illustrates the typical performance of the third grade students in selecting an appropriate mathematical model.

The bus went 20 miles.
Then it went 12 miles
How many miles in all?

How do you find the answer?

9 ○ 32 − 12 = 20
7 ○ 20 × 12 = 240
6 ○ 20 − 12 = 8
78 ● 20 + 12 = 32

The members of the advisory committee felt that the performance of the students on questions in analysis and models was good, particularly in light of the fact that regular instruction in these skills apparently does not take place. The committee members strongly recommended that more instruction be given to students of all ability levels in the skills of problem analysis and modelling. This instructional emphasis should not detract from the development of other skills, but in fact, should help improve application and computation skills by giving students a clearer understanding of the mathematical processes involved in problem solving.

Mathematics Results for Grade Six

Test Scope

The new Survey of Basic Skills: Grade 6 was developed to replace the grade six Survey first given in 1975-76. It assesses the levels of mathematical skills of sixth grade students in California on a more comprehensive set of subskills and is similar in breadth to the new Survey of Basic Skills: Grade 3, which was first used in 1979-80. The development and review process that spanned a period of two and a half years included a large number of California teachers, students, and schools. The result of this process was a comprehensive set of test specifications and the 480 items that appear on the Survey.

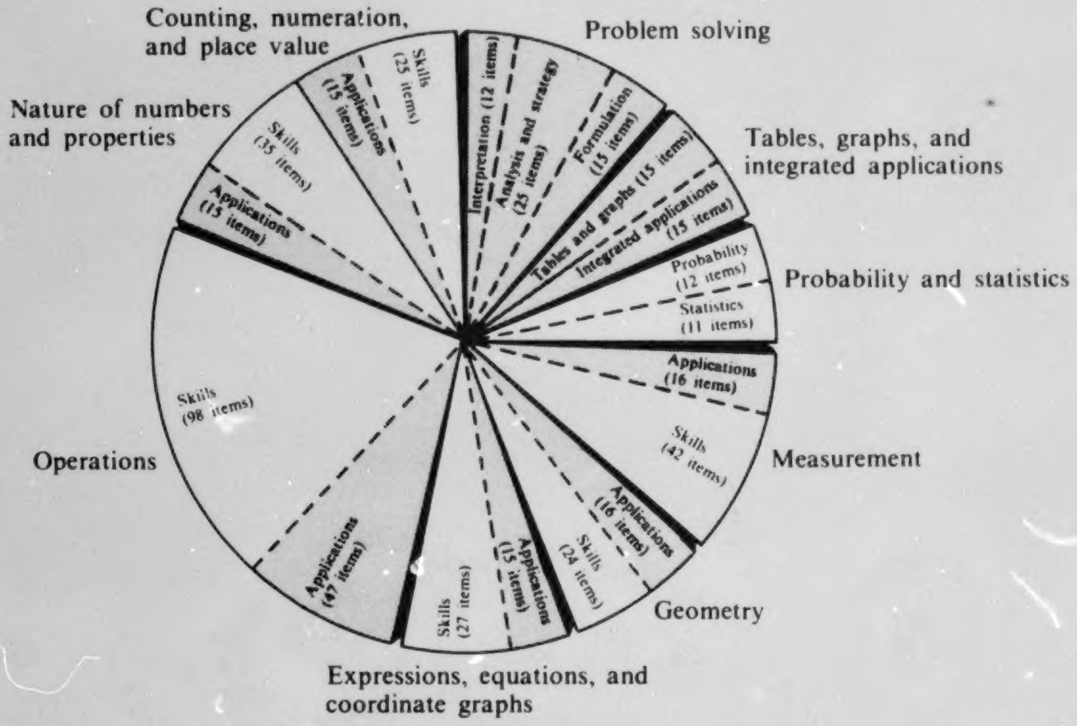

Fig. 25. Number of questions, by skill area, in the mathematics section of the *Survey of Basic Skills: Grade 6*

The 480 items on the Survey were designed to assess students' skills in the area of counting, numeration, and place value; nature of numbers and properties; operations; expressions, equations, and coordinate graphs; geometry; measurement; probability and statistics; tables, graphs, and integrated applications; and problem solving. Figure 25 illustrates the emphasis placed on each skill area in the total test. The emphasis on each skill area in the test is consistent with the mathematics curriculum of most California public schools and additionally reflects the "umbrella" concept of problem solving/applications emphasized in the Mathematics Framework and the 1980 Addendum for California Public Schools: Kindergarten through Grade Twelve. In the new framework, problem solving/applications, rather than being a separate strand, receives equal emphasis with each of the other strands of mathematics. Figure 26 shows the major content categories of mathematics recommended in the 1980 addendum and the "positioning" of the problem solving/application skills. The sixth grade Survey assesses all the skills proposed in the addendum, except for the calculator/computer skills. A detailed description of the skills assessed in the sixth grade Survey is given in Survey of Basic Skills: Grade 6--Rationale and Content.

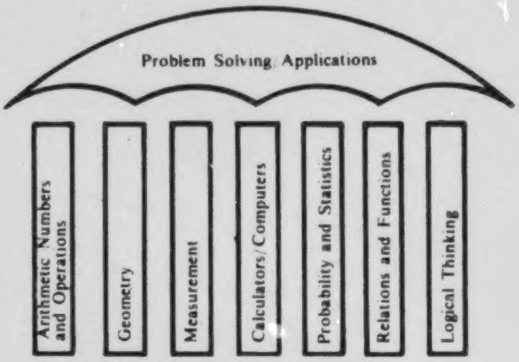
Problem Solving Applications
Arithmetic Numbers and Operations
Geometry
Measurement
Calculators/Computers
Probability and Statistics
Relations and Functions
Logical Thinking

Fig. 26. Problem solving/applications, the umbrella for all strands in mathematics

Mathematics Results for Grade Six

The results of the new sixth grade mathematics assessment for 1981-82 are shown in Table 11. Since for 1981-82 the test was completely revised, longitudinal comparisons are not made between this year's scores and previous years' scores. However, the results from the administration of the old Survey to a sample of California students indicated that percent correct score increased from 60.4 in 1980-81 to 61.6 in 1981-82, an increase of 1.2 percent correct. The scores on the new Survey for this year will serve as a baseline for comparing the skill-by-skill results in subsequent years. Table 11 provides an initial profile of statewide student performance in California.

Mathematics Results, Grade Six

Table 11

Mathematics Scores of California Sixth Grade Students on the Survey of Basic Skills: Grade 6

Skill Area	Number of questions	Average percent correct
MATHEMATICS, TOTAL	480	62.6
Counting, numeration, and place value	40	64.7
Skills	25	66.2
Counting and numeration	15	67.4
Place value	10	64.5
Applications	15	62.1
Nature of numbers and properties	50	61.6
Skills	35	61.5
Ordering and properties	15	67.1
Classification of numbers	20	57.3
Applications	15	62.1
Operations	145	62.5
Skills	98	66.0
Addition/subtraction of whole numbers	15	79.2
Multiplication of whole numbers	14	78.9
Division of whole numbers	15	72.1
Addition/subtraction of decimals	14	58.7
Multiplication/division of decimals	13	55.2
Operations on fractions	15	52.5
Percents and equivalent fractions/decimals	12	63.6
Applications	47	55.4
One-step involving whole numbers	12	68.5
One-step involving rational numbers	20	52.9
Two-(or more) steps	15	48.4
Expressions, equations, and coordinate graphs	42	62.8
Skills	27	61.6
Expressions and equations	15	64.6
Graphs and function tables	12	57.8
Applications	15	64.9
Geometry	40	63.9
Skills	24	63.6
Shapes and terminology	12	66.1
Relationships	12	61.1
Applications	16	64.4
Measurement	58	60.4
Skills	42	61.5
Metric units	20	59.0
U.S. Customary units	10	74.7
Length, area, and volume	12	54.6
Applications	16	57.6
Probability and statistics	23	59.0
Probability	12	53.5
Statistics	11	64.9
Tables, graphs, and integrated applications	30	67.3
Tables and graphs	15	69.1
Integrated applications	15	65.4
Problem solving	52	62.7
Formulation	15	69.6
Analysis and strategy	25	65.0
Interpretation	12	49.4
Solution of problems	154	61.1

Mathematics Results, Grade Six

Table 11 shows that California sixth grade students had an average percent correct score of 62.6 on the 480 questions in the total test. The skill-by-skill results were: 64.7 percent correct in counting, numeration, and place value; 61.6 percent correct in nature of numbers and properties; 62.5 percent correct in operations; 62.8 percent correct in expressions, equations, and coordinate graphs; 63.9 percent correct in geometry; 60.4 percent correct in measurement; 59.0 percent correct in probability and statistics; 67.3 percent correct in tables, graphs, and integrated applications; and 62.7 percent correct in problem solving. From Table 11, the following conclusions are apparent:

- Sixth grade students scored highest in addition/subtraction of whole numbers, with an average percent correct score of 79.2. The next highest subskill scores were 78.9 percent correct in multiplication of whole numbers and 72.1 percent correct in division of whole numbers.

- Sixth-grade students typically scored higher on skill questions than application questions. However, for nature of numbers and properties; expressions, equations, and coordinate graphs; and geometry, students' scores on application questions exceeded their scores on skill questions.

- In operation applications, sixth grade students scored 68.5 percent correct in one-step problems involving whole numbers and 52.9 percent correct in one-step problems involving rational numbers. They scored lowest in applications problems of two or more steps involving whole and rational numbers, with an average percent correct score of 48.4.

- In measurement, sixth grade students scored higher on questions in U.S. Customary units than on the questions in metric units.

- Among the four basic operations, students have most facility with addition, subtraction, and multiplication of whole numbers, followed by division of whole numbers and operations on decimals. Students have the greatest difficulty with operations involving fractions.

The committee members also identified the areas of strength or improvement and areas in need of improvement. The areas of strength included those skills in which students achieved at or above the committee's expectation or the skills in which the scores are below committee's expectations but are improving. The areas in need of improvement included the skills that the committee members would like to have particularly emphasized in the mathematics instructional programs.

Areas of strength

- Identification of rational numbers in word form, given the fraction form
- Identification of the place value of a given digit in a whole number
- Identification of numerals for whole numbers given in expanded notation
- Identification of order symbols
- Identification of order relations for a given set of decimals
- Identification of odd or even numbers
- Identification of multiples of given whole numbers
- Application of the order relation using whole numbers
- Addition, subtraction, and multiplication of whole numbers
- Understanding of the multiplication algorithm for whole numbers
- Reduction of fractions to the lowest terms
- Applications, one-step, using addition of whole numbers
- Evaluation of simple expressions involving addition, subtraction or multiplication
- Identification of appropriate linear units of measure
- Calculation of perimeters of common geometric figures
- Identification of the mode of a given list of data
- Interpretation of data given in the form of a table
- Identification of relevant mathematical problems for given situations
- Identification of facts, questions, or unknowns in given problems

Areas in need of improvement

- Identification of the place value of a given digit in a decimal
- Understanding of the exponential form of a number
- Identification of prime numbers and prime factors
- Identification of the least common multiple and greatest common factor for whole numbers
- Division of decimals
- Addition and subtraction of fractions with unlike denominators
- Multiplication and division of fractions
- Applications, one-step, involving multiplication or division of fractions
- Applications, one-step, involving division of decimals
- Applications, two-step, involving fractions
- Estimation of nonlinear meaures of familiar objects (metric units)
- Calculation of areas and volumes of common geometric figures
- Calculation of probabilities of simple events
- Interpretation of data given in the form of a circle graph
- Selection of appropriate operations to solve given problems that involve division
- Checking a given answer in a problem
- Recognition of a sensible answer to a given problem

The committee's recommendations

- Increased instructional emphasis should be given to the sharpening of the concept of place value leading to the understanding of the role of zero in numeration and decimal notation.

- It is recommended that instructional emphasis be continued in the use and understanding of metric units.

- Increased instructional emphasis on the understanding and reading of Cartesian coordinate graphs through the use of paper/pencil games and computer-assisted activities is recommended.

- The representations of division expressions should be varied so that students are aware of the different forms used.

- The instructional emphasis on the development of problem-solving skills, particularly estimation and checking skills, and on recognition of sensible answers should be continued.

- The committee members cautioned against the tendency to develop a narrow, computational, minimum proficiency-based mathematics curriculum in grades four, five, and six. They felt that all students need a broad, comprehensive instructional program in these grades, covering all objectives in the mathematics framework. Concern was expressed that a substantial number of students are being trapped in a repetitive cycle of arithmetic computation instruction and are not being exposed to any other mathematical concepts or skills throughout their school years.

Committee's Analysis of Skill Area Results

The members of the Mathematics Assessment Advisory Committee reviewed the results of the sixth grade students, by skill area and by items within each skill area. The committee members judged the adequacy of student performance in light of the difficulty of the questions and the relative instructional emphasis of each skill in the typical classroom.

The instructional emphasis data were provided by the teachers who reviewed the test questions during the test construction phase of the sixth-grade Survey. The teachers indicated whether the emphasis on a particular skill in their school was great, some, little, or none. They also indicated whether the level of skill considered appropriate[1] in grade six was mastery, developmental, exploratory, or not introduced.

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[1] Mastery: The student is functionally competent and able to apply skills and knowledge in an organized and effective way.

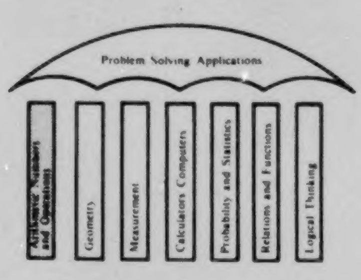
Developmental: The student is in the process of learning a concept or skill.

Exploratory: The student is being introduced with some degree of guidance to new concepts, materials, or skills.

The results of the committee's analysis are summarized below, by major skill area. The main purpose of this analysis was to point out areas of strengths and weaknesses that may form the basis for further improving instruction in California classrooms. Illustrative examples indicating students' actual performance are provided to indicate areas of special strengths or weaknesses; however, these examples should not be taken as indicative of the typical student performance in an entire skill area.

Arithmetic numbers and operations

The skills included under arithmetic numbers and operations are counting, numeration, and place value; identifying relational symbols and phrases; identifying the least or greatest whole number, decimal, or fraction from among several numbers, using the commutative, associative, and distributive properties and properties of one and zero; identifying factors, multiple, least common multiple, greatest common factor; and the basic operations of addition, subtraction, multiplication, and division on whole numbers, decimals, and fractions.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The committee members felt that, in general, students performed well on addition, subtraction, and multiplication problems presented in vertical format. The committee members were very pleased to note that students performed well on most operation problems with whole numbers, even those with a number of renamings. Notable success was achieved on a subtraction problem that included three renamings and a double zero in the minuend. This problem was correctly solved by 85 percent of the students.

$$\begin{array}{r} 4003 \\ -\ 209 \\ \hline \end{array}$$

5 ○ 4794
2 ○ 3806
8 ○ 3804
85 ● 3794

The following problem, which includes two renamings along with numbers generally considered to be difficult, was answered correctly by 95 percent of sixth grade students:

$$\begin{array}{r} 7876 \\ +\ 6689 \\ \hline \end{array}$$

95 ● 14,565
2 ○ 14,555
2 ○ 14,465
1 ○ 13,455

Of the several areas in which students had difficulty, two areas drew particular attention from the committee members--mathematical vocabulary and understanding of place value. The committee discussion in these two areas follows.

Mathematical vocabulary. Students have some difficulty understanding and using the vocabulary of arithmetic. On the following item, 25 percent of the students did not know that "finding the difference" involves subtraction. Six percent of the students selected addition, and 13 percent chose division for their answers.

To find the difference between 83 and 18, you:

6 ○ add
75 ● subtract
5 ○ multiply
14 ○ divide

Similarily, for multiplication, only 46 percent of the students correctly identified the "product" of 8 and 2. Twenty percent chose 4 as the product, and 30 percent chose 10. Although division vocabulary was not tested as such, the results on the following item indicate that students had a fair understanding of the relationship between the horizontal format and the more traditional algorithm; seventy-two percent of the students chose the correct response.

$75 \div 25 = 3$ is the same as:

2 ○ $\begin{array}{r}75\\ 3\overline{)25}\end{array}$ 15 ○ $\begin{array}{r}3\\ 75\overline{)25}\end{array}$

11 ○ $\begin{array}{r}25\\ 3\overline{)75}\end{array}$ 72 ● $\begin{array}{r}3\\ 25\overline{)75}\end{array}$

The California Assessment Program test assesses students' understanding of such words and terms as factor, product, addend, sum, even, odd, prime number, prime factor, divisible by, multiple, least common multiple, greatest common factor, and common divisor. During the test development phase, 95 percent of the teachers who responded on a statewide survey indicated that they considered the terminology for addition, subtraction, multiplication, and division at the mastery or developmental level; however, corresponding percentages for prime number, greatest common factor, and lowest common multiple were 45 to 49 percents.

The committee members expressed concern over the low scores in terminology and related concepts, especially because of their conviction that mathematical terminology and symbols constitute the "grammar" of mathematics. In learning a foreign language, students study vocabulary and grammar, it is as important for students of mathematics to understand and use mathematical terms as it is to learn the syntax of the foreign language. The committee members emphasized that learning the language of mathematics should begin in the early grades and should continue throughout the school's mathematics program.

Place Value. Questions in place value on the sixth grade Survey ranged from identification of numbers "100 more than" or "100 less than" to operations with decimal fractions. The committee members noted a lack of understanding of place value concepts, required of sixth grade students, throughout the arithmetic section of the test. The following example is a clear illustration of place value difficulty:

100 less than 32,013 is:

			Response Characteristics
4	○	32,913	Failure to rename
8	○	32,113	Using a wrong operation
65	●	31,913	Correct answer
23	○	31,013	Subtracting from thousands instead of hundreds

In the above example, although 65 percent of sixth grade students correctly answered the item, 23 percent confused the hundreds place with the thousands place, selecting 31,013 as the answer.

Although sixth grade students lack a deeper understanding of the place value concepts, they seem to understand place values for whole numbers and perform well on whole number addition and subtraction questions even those with a number of renamings. However, students seem to have considerable difficulty with decimal fraction operations. In the following example, 19 percent of the students confused tens place with the required tenths, while about 29 percent incorrectly selected a numeral showing the seven in either the ones or hundredths place. The question was answered correctly by 52 percent of the students.

Which numeral has a 7 in the tenths place?

19	○	976.3
16	○	97.63
52	●	9.763
13	○	0.9763

In the following decimal subtraction problem, 36 percent of the students ignored the decimal point, while another nine percent failed to note the difference between the tenths place and the hundredths place.

95.6 - 8.05 =

36	○	0.151
9	○	87.1
51	●	87.55
4	○	103.65

Confusion was even greater in operation questions involving whole numbers and decimals. The problem below was answered correctly by only 33 percent of the students. Sixty-one percent of the students obviously placed a decimal point before the number 12 before adding and then selected the first answer as correct.

0.35 + 5.28 + 12 =

61 ○ 5.75
2 ○ 17.53
33 ● 17.63
4 ○ 575

The results were similar for other operations with decimal fractions: students ignored decimal points, improperly aligned horizontally presented problems, and failed to understand the meaning of fractional place values.

Although positional value is not technically considered place value, a similar related difficulty arose with positional value. In grades prior to the sixth grade, it is common to find students subtracting a partial minuend from a partial subtrahend instead of doing the necessary renaming. For example:

$$\begin{array}{r} 84 \\ -\ 27 \\ \hline 63 \end{array}$$

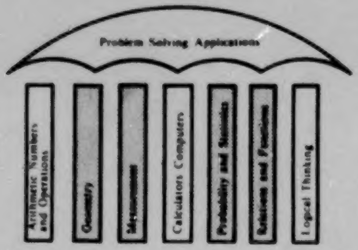
This lack of understanding extends to operations with fractions at the sixth grade level. For the problem below, 47 percent of the students chose the response 2 1/4, not realizing that 1/4 should be subtracted from a renamed unit. Another 10 percent of the sixth graders selected 2 3/4, also failing to rename.

$$\begin{array}{r} 8 \\ -\ 6\frac{1}{4} \\ \hline \end{array}$$

10 ○ $2\frac{3}{4}$ 39 ● $1\frac{3}{4}$
47 ○ $2\frac{1}{4}$ 4 ○ $1\frac{1}{4}$

The committee members remarked that although sixth grade students have a basic understanding of place value skills, the concept of place value needs additional emphasis in classrooms to sharpen students' understanding. The members also observed that the fraction items on the test are all commonly used fractions such as 1/2, 2/3, 3/4, etc., and that the students were unable to show facility in performing operations with such fractions. They emphasized the role of fraction operations, especially as it relates to achieve success in learning algebra.

Expressions, geometry, measurement, and probability and statistics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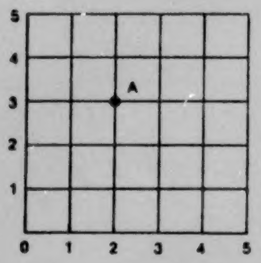
Each of these sections of the test consists of a section on computational skills or recognition subskills and an applications section involving word problems. The results on the application items are described in the next section; the results on the skills items are presented next.

Expressions, equations, and coordinate graphs. The questions in this part of the Survey involve translation of algebraic expressions into English phrases, evaluating simple algebraic expressions, locating points on a coordinate graph, and identifying either the rule or a missing number in a function table.

The survey of teachers during the test construction phase indicated that most of the skills in expressions and equations were at the exploratory level. The committee was generally satisfied with the score of 62.8 percent correct in these skills, which was slightly above the total mathematics score of 62.6 percent correct. Among the items on coordinate graphs and function rules and skills, the committee observed that the scores were consistently low only in the subskill of identifying points on the coordinate plane. A closer look at the student responses indicated that most of the errors that occurred involved reversing the order of the coordinates (see the example below).


5
4
3
2
1
0
1
2
3
4
5
A

What ordered pair gives the location of Point A?

2 ○ (3, 3)
51 ○ (3, 2)
2 ○ (3, 4)
45 ● (2, 3)

The committee members indicated a need to emphasize "conventions," such as in ordered pairs, in the classroom.

Geometry. The questions in this part of the test involve identifying two- and three-dimensional geometric shapes, recognizing line segments, rays, radii, diameters, type of angles and triangles, parallel and perpendicular lines, and similar and congruent figures. The questions also pertain to lines of symmetry, measurement of angles with the help of a protractor, and recognition of spatial relationships.

The survey of teachers indicated that "some" or "little" emphasis was placed in the classroom on these skills and that the skill level was considered developmental or exploratory, but that the teachers did want these skills tested on the *Survey*. The students scored 66.1 percent correct on shapes and terminology and 61.1 percent correct on relationship questions. The committee's review of these items revealed that students had some difficulty with the perpendicularity relationship in particular, and with spatial relationships in general. Students were especially strong in identifying angles and congruent figures.

Measurement. The questions in this part of the *Survey* include subskills on estimating length, area, volume, and mass; choosing appropriate units for measuring an object of a given length, area, volume, or mass; and converting from one unit to another within the particular system. The questions include items on both metric and U.S. Customary units, with a predominance of the questions dealing with metric units.

Choose the most appropriate unit to measure the length of a paper clip.

13 ○ meter
9 ○ kilometer
11 ○ decimeter
67 ● centimeter

The committee's review of these items revealed that students are weak in understanding of measurement units in the metric system, in understanding of concepts involving volume, and in recognition of basic formulas and their application. On the example below, 67 percent of the students answered the question correctly; however, the remaining 33 percent apparently had no knowledge of metric measures of length.

Probability and Statistics. The questions on probability require students to select the probability of an event or the complement of an event, identify the probability for an event certain to occur or not to occur, and find probability associated with, for example, the tossing of a coin or the stopping of a pointer of a spinner. The questions on statistics include items on finding the mean, median, mode, and range of a given set of numbers. All questions in this category are presented in simple application format involving real life situations.

The survey of teachers during the test construction phase of the *Survey's* development indicated that they place little or no instructional emphasis on skills involving probability; teachers identified most skills at either the exploratory level or "not introduced." The committee felt that lesser emphasis on these skills in classrooms is probably due to a lack of instructional materials in many textbooks. However, students scored 59.0 percent correct on these items, which was lower than the score for the total test but higher than the committee members expected. In statistics, with the exception of the computation of the average of a given list of data, teachers rated skills in the same way that they rated probability skills. The scores of students on statistics items was 64.9 percent correct, which was higher than the average percent correct for the total test. The following example illustrates the performance of students on a typical probability question:

STUDENT WORKERS	
Class	Number
Grade 5	210
Grade 6	200
Grade 7	260
Grade 8	220

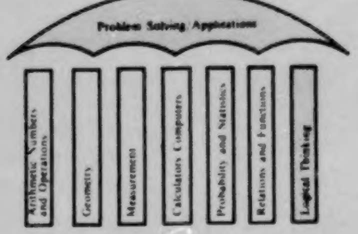
If the name of one of the students in the classes above is chosen at random for a certain job, that student will most likely be in.

3 ○ Grade 5
13 ○ Grade 6
63 ● Grade 7
21 ○ Grade 8

The committee members recommended greater instructional emphasis on probability and statistics in classrooms. The basis for their recommendation was the broad general usage of these concepts in the everyday lives of our citizens and the importance of these skills in preparing for business and technology.

Problem solving/applications

In order to assess student performance in problem solving/application skills, the committee incorporated several unique design features into the new Survey. First, the test contains questions in skills as well as applications for each major strand of mathematics. Second, it includes matched questions such that a computational question has its parallel in a word problem involving the same computations. Third, a variety of application questions are designed to assess student achievement in one- and multi-step word problems. Fourth, problem-solving questions unique to CAP were written by committee members to assess achievement in problem formulation, analysis and strategies, and problem interpretation. Fifth, integrated applications, also unique to CAP, are intended to assess skills involving knowledge in two or more math skills in a "life coping" situation. Whereas skill questions assess student achievement in computational skills, the one-step problems assess achievement in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identification of correct operations, and multi-step problems assess ability in critical thinking in a problem situation. On problem-solving questions, students are required to think about the situation and respond with something other than the result of an arithmetic computation.

One-step applications. A one-step application problem is a word problem that is reduced to a one-step computation--adding, subtracting, multiplying, or dividing. The problems on the test involve both whole numbers and rationals (decimals and fractions).

The average score on one-step problems involving whole numbers was 68.5 percent correct as compared to 52.9 percent correct for similar problems involving rationals. The difference in student performance on whole number and rational number applications is primarily the result of students' not having mastered computational skills in decimals (55.2 percent correct on multiplication and division and 58.7 percent correct on addition and subtraction) or fractions (52.5 percent correct) to the same degree that they have mastered computations with whole numbers (79.2 percent correct in addition and subtraction, 78.9 in multiplication, and 72.1 in division). In one-step problems, the context of the problem is relatively unimportant except to identify the choice of the operation. The following examples illustrate student performance in one-step whole number application and in one-step decimal applications:

The phone book has 17,751 listings of businesses and homes. 2,686 are for businesses. How many are for homes?

74 ● 15,065
5 ○ 15,135
6 ○ 15,165
15 ○ 20,437

A paper clip weighs 0.5 gram. A piece of paper weighs 0.03 gram. How much would the paper and the paper clip weigh?

13 ○ 0.008 gram
7 ○ 0.015 gram
36 ○ 0.08 gram
44 ● 0.53 gram

When the same numbers were given as whole number or decimal computations, 92.1 percent of the students correctly answered the whole number question, and 61.0 percent correctly answered the decimal question. Student responses revealed that most of the students knew the correct operations; however, many made errors in aligning the decimals or place values of numbers. About one-half (46 percent) of the sixth graders chose the wrong answer because they aligned the right most digits of two decimal numbers without regard to the decimal position.

Multi-step applications. The word problems in this category involve two or more steps of operations. The percent correct for multi-step problems was 48.4, which was not only lower than the score for one-step problems involving whole or rational numbers but also the lowest score on the Survey. In contrast to one-step problems, in which the context of the story is unimportant, in two- (or more) step problems, the context of the story becomes important for correct solution. The example below illustrates the performance of sixth grade students on a two-step problem that involves identifying the features that are significant to the central problem.

It is 1.3 kilometers from Sharon's house to school. She rides her bicycle to and from school every day. How far does she ride in 5 days?

7 ○ 6.3 kilometers
68 ○ 6.5 kilometers
5 ○ 10 kilometers
20 ● 13 kilometers

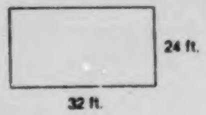
In the above question, the predominant error (68 percent) resulted from students' ignoring "to-and-fro" parts of the question and answering simply 1.3 x 5 = 6.5. The correct solution requires additional multiplication: 2 x 6.5 = 13. In multi-step problems, a general error was to respond as if only one step were required. The committee members noted that questions such as these have been used infrequently in commonly used grade six textbooks. They recommended that teachers spend more time in developing critical thinking skills through class discussions and homework assignments using concrete problem situations. Since computation is not the critical skill to develop thinking skills, the committee members emphasized the use of calculators in conjunction with class discussion and homework assignments for such problems.

Applications in expressions, equations, geometry, measurement, graphs, and integrated applications. The application questions in these categories involve applications of skills in practical situations. From Table 11 it is apparent that the percent correct for applications was greater than the percent correct for skills in geometry (64.4 vs 63.6) and expressions and equations (64.9 vs 61.6). Of the nine major categories on the *Survey*, the highest score was 67.3 percent correct for tables, graphs, and integrated applications.

The committee's review indicated that generally where students are weak in applications they are also weak in skills. On measurement computation questions, students were able to find perimeters of figures when measurements are given on the figure, but in most application problems they seem to apply the given numbers in a random fashion without regard to their meaning in the problem (see the following example).

Jim and Judy wanted to put a rail fence around their rectangular lot. They wanted the posts to be spaced eight feet apart.

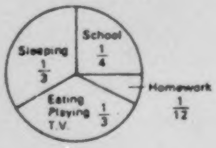
How many posts will they need?



22 ○ 12
42 ● 14
20 ○ 16
16 ○ 18

The students in the sixth grade are also weak in interpreting data from circle graphs (49.8 percent correct) and interpreting data from charts (51.9 percent correct). The example that follows illustrates their performance on a circle graph question:

What part of Sam's day is spent eating, playing, watching TV, and sleeping?

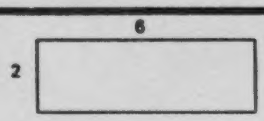


38 ○ $\frac{1}{3}$
3 ○ $\frac{1}{2}$
13 ○ $\frac{7}{12}$
46 ● $\frac{2}{3}$

Student scores were strong, however, in interpretation of data from tables (83.0 percent correct) and interpretation of data from bar graphs (75.7 percent correct). In general, students did better on items where they simply had to read a table or graph than on items that required them to interpret information or do some computation with the data.

Problem Solving. Of the three types of questions in this category, problem formulation, analysis and strategy, and interpretation, students scored highest (69.6 percent correct) on problem formulation questions and lowest (49.4 percent correct) on interpretation questions. In fact, after the multi-step application problems, interpretation problems were the most difficult of all skills on the math portion of the *Survey*.

Problem Formulation. The skills in problem formulation include identifying problems or situations that can be represented by given mathematical models, such as number sentences, equations, diagrams, tables, and graphs. The following example illustrates the performance of sixth grade students on a question in problem formulation:



Which problem is suggested by the above diagram?

16 ○ What is the diameter of a 6-inch circle?
67 ● What is the area of the floor?
12 ○ How much will it cost for 8 items?
5 ○ How many halves are there in 6 apples?

The committee members noted that students were able to match a word problem to a given number sentence when the numbers in the problem were dollars and cents, but noted that students found a similar problem involving decimals more difficult. In all cases, where a drawing or diagram was presented, the students had some difficulty applying it to a correct problem situation. In the example above, only 67 percent responded correctly, while approximately 26 percent chose either the first or third response.

Analysis and Strategy. Analyzing problems involves identifying the significant features of the central problem and planning strategies to deal with them. Planning might involve guesswork, estimation, drawing of diagrams, creation of concrete models, listing of similar elements, or breaking of the problem into manageable parts. A critical step in problem analysis is translation of the problem into mathematical symbols, because it demands an explicit definition of the problem and selection of an appropriate strategy for solving it. The step also demands risk taking. The following example is from the questions on identifying given facts, unknowns, or questions (significant features) in a given problem:

36 children are in the room. 4 children are sitting at each table. How many tables are being used by the children?

. . . . . .

What are you asked to find out?

3 ○ The number of children in the room.
75 ● The number of tables being used.
18 ○ The number of children at each table.
4 ○ The number of children in 4 rooms.

Although about 75 percent of the students answered questions similar to the above example correctly, the responses of the students on other questions indicated that they are not reading discriminately. The students are not paying attention to specific details in the prose or the specific question asked.

The next example is an illustrative question requiring an appropriate operation that will lead to the solution of a given problem.

Mr. Higgins made 2 hamburgers for each child at the picnic. In all, he made 32 hamburgers. How many children were at the picnic?

. . . . . .

Which expression will help you solve the problem?

20 ○ 32 × 2
6 ○ 32 + 2
45 ● 32 ÷ 2
29 ○ 2 ÷ 32

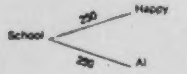
The committee members noticed that students have some difficulty knowing when to multiply or divide, and the larger the number in the problem, the more difficulty they have in selecting the appropriate operation. Students also seem to have difficulty relating a division problem with its horizontal form. In the example just presented, 74 percent of the students knew that division was the appropriate operation, but only 45 percent selected the correct response.

The example below is an illustration from questions on identifying mathematical models, such as number sentences, charts, and tables for a given problem. The example was answered correctly by less than half the students.

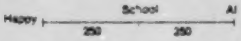
Happy and Al lived the same distance from the school, but in opposite directions. They found that they lived 500 meters apart.

Which drawing shows this?

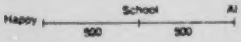
15 ○



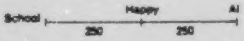
46 ●



36 ○



3 ○



The committee members felt that perhaps many students have had little experience making drawing or diagrams of mathematical situations.

The following example is an illustration from questions on identifying missing or extraneous information in a given problem.

The 130 students from Marie Curie School are going on a picnic in Carson Park. Carson Park is 12 miles from the school. Each bus holds 50 passengers. How many buses are needed?

Which numbers are needed to solve this problem?

9 ○ 130 and 12
63 ● 130 and 50
12 ○ 12 and 50
16 ○ 130, 12, and 50

The committee members noted that such problems are relatively new to most math programs and textbooks. Yet, it is imperative that, in real-life situations, students be able to sort through the information they have (or identify information they do not have) and select the relevant data. Only 63 percent of the students were able to select the relevant numbers in the example just given.

The example below is an illustration from questions on using guess and check (trial and error) strategies to solve problems. Guessing and checking, or trial and error, is an appropriate starting point when a method to solve a problem is not immediately apparent.

☐ × ☐ = 1849

The number in each box is the same.

2 ○ The number is between 0-10.
30 ● The number is between 11-50.
36 ○ The number is between 51-100.
32 ○ The number is larger than 100.

This approach, which is used frequently by adults in everyday situations, seems to be almost unknown to sixth grade students. In the example above the last three responses were chosen almost equally by the students.

The ensuing example is an illustration from questions on estimation to predict reasonable solutions and identification of problem solving tactics needed to solve a given problem:

Yolanda bought groceries that cost $3.65, $1.25, $4.99, $27.95, and $0.15.

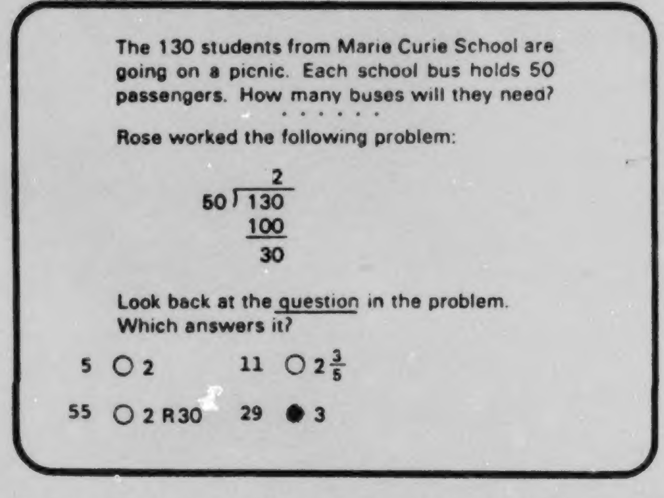
Which of these is the best estimate of her total cost?

16 ○ $4 + $2 + $5 + $28 + $1
23 ○ $3 + $1 + $4 + $27 + $0
52 ● $4 + $1 + $5 + $28 + $0
9 ○ $4 + $1 + $5 + $27 + $0

The committee members remarked that rounding and estimation are frequently used in everyday life, whether one is shopping for groceries, determining cooking time for a dinner, or determining whether an answer to a problem worked on a calculator is reasonable. Yet, most students get very little practice in estimating. In the example, only simple rounding skills are necessary to determine the solution, yet only 52 percent of the students answered this item correctly.

Interpretation. Interpretation skills require students to review the problems and answers, judge the validity of their translations to mathematical symbols, and check the accuracy of their use of mathematical rules.

The example below requires students to check their solutions in the context of the original problem. The committee members remarked that students are accustomed to using arithmetic to solve word problems and that they have "learned" that the answer to their arithmetic is the "correct" answer to the word problem.



The 130 students from Marie Curie School are going on a picnic. Each school bus holds 50 passengers. How many buses will they need?

. . . . . .

Rose worked the following problem:

$$\begin{array}{r} 2 \\ 50\overline{)130} \\ \underline{100} \\ 30 \end{array}$$

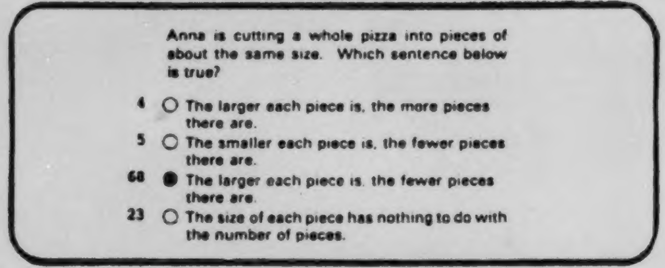
Look back at the question in the problem. Which answers it?

5 ○ 2 11 ○ $2\frac{3}{5}$

55 ○ 2 R30 29 ● 3

They need to have more experience in "making sense" out of the answer. In the example there are several "correct" answers to the arithmetic problem, but there is only one "sensible" answer to the question in the word problem.

The next example is an illustration from questions that require students to draw reasonable conclusions by analyzing or interpreting given information.

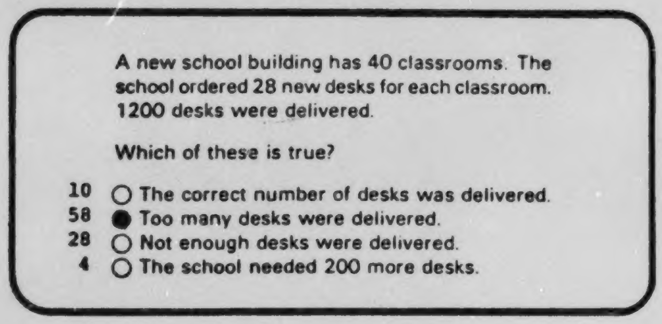


Anna is cutting a whole pizza into pieces of about the same size. Which sentence below is true?

4 ○ The larger each piece is, the more pieces there are.
5 ○ The smaller each piece is, the fewer pieces there are.
68 ● The larger each piece is, the fewer pieces there are.
23 ○ The size of each piece has nothing to do with the number of pieces.

The committee members noted that many students have some difficulty interpreting information and relating it to their experiences. In the example above nearly one-fourth of the students stated that the size of the pieces in a pizza is not related to the number of pieces cut.

Even in a relatively straightforward computation problem (see the example that follows), less than 60 percent of the students were able to draw a reasonable conclusion from the given information.



A new school building has 40 classrooms. The school ordered 28 new desks for each classroom. 1200 desks were delivered.

Which of these is true?

10 ○ The correct number of desks was delivered.
58 ● Too many desks were delivered.
28 ○ Not enough desks were delivered.
4 ○ The school needed 200 more desks.

Summary of Committee's Conclusions

In general, the sixth grade students performed fairly well in analyzing and solving straightforward word problems involving addition or subtraction of whole numbers. They did not perform as well when the operation required was multiplication or division. Problems that included fractions, decimals, or percents, even where no calculations were necessary, were, in most instances, difficult for the students.

It appears that many students are not reading the problems critically. This does not seem to be a function of reading comprehension alone, since higher percent correct were recorded for some very "wordy" problems than for some very short problems. Students seem to to lack the ability to take the situation stated in the problem and go one step further to make some analysis or inference based on that situation. In other instances, the students seem to be making their own assumptions about the nature of the problem and disregarding specific details in the situation, the question asked, or the response choices.

The students seem to have few problem-solving strategies, other than those that involve working an arithmetic problem, available to them. They have some difficulty recognizing models or drawings, using a guess and check technique, and identifying simple problems as alternate approaches to solving problems.

Sex Differences In Mathematics Performance

Boys and girls in the third and sixth grades answer approximately the same number of mathematics problems correctly, but they differ on the particular items they able to solve. Table 12 illustrates the differences in the performances of girls and boys in various skills at the third and sixth grades.

Table 12

Differences in Achievement of Girls and Boys for All Mathematics Areas of the Third- and Sixth-Grade CAP Tests, 1981-82

Category	Girls average score - Boys average score third grade	sixth grade
Counting and place value		
Computations	-0.10	-0.74
Applications	+0.54	-3.41
Nature of numbers and properties		
Computations	+1.32	+0.4
Applications	+0.75	-0.58
Arithmetic operations		
Computations	+1.89	+2.30
Applications	-0.62	-1.48
Geometry		
Computations	+1.34	-1.57
Applications	+1.31	-0.83
Measurement		
Computations	-1.64	-2.56
Applications	-0.68	-2.56
Patterns/graphs		
Computations	-0.19	+0.84
Applications	+1.88	-0.24
Probability	----	-3.87
Statistics	----	-0.43
Problem analysis	+2.88	+1.37

The values in Table 12 were obtained by subtracting the average boys' score from the average girls' score. A negative value means that boys performed better than girls. A positive value means that girls performed better than boys.

Mathematics Results, Grade Six

In terms of the numbers of areas in which one sex or the other excels, girls are are outperforming boys at the third grade level. Of the 15 types of problems given in Table 12, third grade girls surpass third grade boys on eight. The situation changes in the sixth grade. Of the 15 types of problems listed, girls surpassed boys on only four. Moreover, the differences between boys' and girls' scores are greater at the sixth grade than at the third grade.

One surprising result is that, although sixth grade boys do better than sixth grade girls on problems of application, they are less capable than girls on questions of problem analysis. The problem analysis questions ask the students to identify relevant information in a problem, to estimate an answer, and to identify the appropriate mathematical model. The following example requiring students to analyze the problem shows that four percent more girls than boys answered the question correctly.

36 children are in the room. 4 children are sitting at each table. How many tables are being used by the children?

Boys	Girls	What are you asked to find out?
4	3	○ The number of children in the room.
73	77	● The number of tables being used.
18	17	○ The number of children at each table.
5	3	○ The number of children in 4 rooms.

The results that grade six boys are better at applications than girls is not surprising. Similar results have been published by CAP in previous years and have been found in other studies. The findings on the analysis questions indicate, however, that sixth grade girls have developed problem-solving skills but that they are not using these skills on application items.

The largest and most consistent difference between boys' and girls' performance on the CAP tests is in the area of measurement. Girls are weaker in both skills and applications in this area (in both the third and sixth grades). For example, on the sixth grade test, the following item appears:

Choose the best unit to measure the length of a swimming pool.

- ○ degree
- ○ foot
- ○ gallon
- ○ mile

Four times as many girls as boys selected "mile" as the best unit to measure a swimming pool. Eight percent of all girls made this choice. Similarly, girls have difficulty in estimating size:

A hand is used to measure the height of a horse. The hand is 4 inches long. How tall is a horse that measures 15½ hands?

○ 15½ inches
○ about 5 feet
○ 62 feet
○ 15½ feet

Over 16 percent of all girls responded that the horse would be 15½ inches high, and another 18 percent felt that it would be 62 feet tall. While many boys also made these errors, they did so in fewer numbers. Sixty percent of the boys answered correctly; only 50 percent of the girls did so.

Similar problems exist with measurement at the third grade level. On items requiring a student to read scales (such as a thermometer), girls performed more poorly than boys.

The findings suggest that boys have more contact with measurement problems than girls do. Perhaps boys have more experience in this area outside the classroom. The mathematics committee recommended that teachers stress measurement instruction with girls and that classroom situations requiring active measurement computation and application be presented frequently to all students.

Mathematics Test Results for Grade Twelve

Test Scope

The Survey of Basic Skills: Grade 12 was developed to assess the degree to which students have acquired "basic" mathematics skills by the end of the twelfth grade. A statewide committee compiled objectives and reviewed questions for inclusion in the test. The 198 questions on the Survey were designed to assess students' skills in the areas of arithmetic, algebra, geometry, measurement, and probability and statistics. Figure 27 is an illustration of the emphasis given to each skill area in the total test. In the figure the skill area of arithmetic is subdivided into the areas of number concepts, whole numbers, fractions, and decimals. A complete description of the skills assessed on the Survey is given in Test Content Specifications for the Survey of Basic Skills: Mathematics, Grades Six and Twelve (Sacramento: California State Department of Education, 1975).

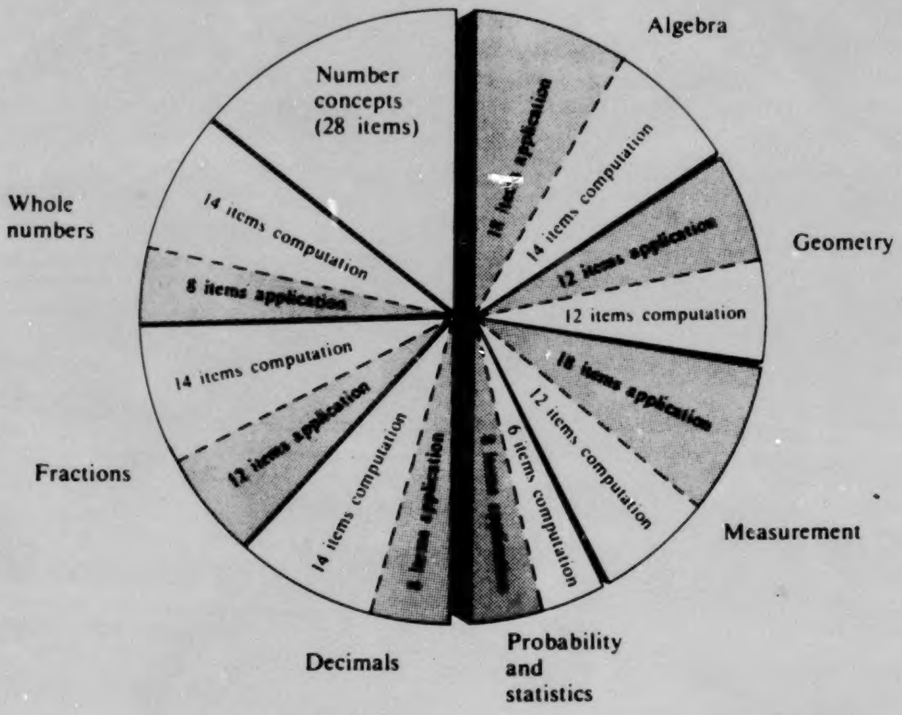


Fig. 27. Number of questions, by skill area, in the mathematics section of the *Survey of Basic Skills: Grade 12*

Mathematics Results for Grade Twelve

Table 13 contains the twelfth grade Survey results for the total test and for the five major content categories assessed on the Survey--arithmetic, algebra, geometry, measurement, and probability and statistics. The results are presented for the computation and application portions of each skill category. Additionally, the results are presented for the category of problem solving, which is an aggregation of application questions in arithmetic, algebra, and measurement. Table 13 shows the scores for 1975-76 through 1981-82 and the changes in scores over the same seven-year period.

A graphical representation of these skill area results for the seven-year period appears in figures 28 and 29. The following overall conclusions are apparent from the data in Table 13 and figures 28 and 29:

- The overall mathematics achievement of California twelfth grade students decreased slightly, by 0.3 percent correct, from 1980-81 to 1981-82.
- The 1981-82 score of 67.7 percent correct was the second highest score for the seven years of testing, being surpassed only by the 1980-81 score of 68.0 percent correct.
- Computation scores have consistently increased over the seven-year period, with an overall increase of 2.7 percent correct for computation with whole numbers, a 1.1 percent correct increase for computation with fractions, and a 5.1 percent correct increase for computation with decimals.
- Application scores have fluctuated slightly over the seven-year period, with an overall decrease of 0.7 percent correct for applications involving whole numbers, a 1.0 percent correct decrease for applications involving fractions, and a 2.1 percent correct increase for applications involving decimals.
- Number concept scores have remained nearly constant over the seven-year testing period with an overall increase of 0.7 percent correct. However, number theory and number properties scores did decrease 0.8 and 0.7 average percent correct, respectively, in 1981-82 from the 1980-81 scores.
- Algebraic concept scores also remained nearly constant over the seven-year testing period, with an overall increase of 0.3 percent correct.
- Geometry scores remained essentially constant, with a decrease of 0.3 percent correct for the seven-year testing period. No change occurred in the scores from 1980-81 to 1981-82.
- Measurement scores have generally declined over the seven years, with an overall decrease of 1.2 average percent correct.

- Probability and statistics scores increased over the seven-year testing period by 1.6 percent correct. Although the 1981-82 score decreased by 0.4 percent correct from that of 1980-81, this skill area showed the second highest increase in percent correct score over the seven-year period.

- Problem solving skills decreased by 0.5 percent correct over the seven-year testing period.

Table 13

Mathematics Scores of California Twelfth Grade Students and Change in Scores on the Survey of Basic Skills: Grade 12, 1975-76 Through 1981-82

Skill area	Number of questions	Average percent correct score							Change in average percent correct score					
		1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82	1975-76 to 1976-77	1976-77 to 1977-78	1977-78 to 1978-79	1978-79 to 1979-80	1979-80 to 1980-81	1980-81 to 1981-82
MATHEMATICS, TOTAL	198	67.0	66.3	66.3	66.5	66.8	68.0	67.7	-0.7	-0-	+0.2	+0.3	+1.2	-0.3
Arithmetic	98	72.9	72.1	72.2	72.7	73.1	74.5	74.3	-0.8	+0.1	+0.5	+0.4	+1.4	-0.2
Number concepts	28	74.3	73.5	73.6	73.9	74.1	75.4	75.0	-0.8	+0.1	+0.3	+0.2	+1.3	-0.4
Number and numeration	14	71.0	70.1	69.9	70.1	70.6	72.1	72.1	-0.9	-0.2	+0.2	+0.5	+1.5	-0-
Number theory	8	76.2	75.9	76.4	76.9	76.7	77.7	76.9	-0.3	+0.5	+0.5	-0.2	+1.0	-0.8
Number properties	6	79.6	78.5	78.6	78.8	78.7	79.8	79.1	-1.1	+0.1	+0.2	-0.1	+1.1	-0.7
Whole numbers	22	80.1	80.1	80.1	80.6	81.0	81.7	81.6	-0-	-0-	+0.5	+0.4	+0.7	-0.1
Computation	14	80.9	81.0	81.2	81.9	82.4	83.5	83.6	+0.1	+0.2	+0.7	+0.5	+1.1	+0.1
Application	8	78.7	78.5	78.2	78.3	78.4	78.6	78.0	-0.2	-0.3	+0.1	+0.1	+0.2	-0.6
Fractions	26	66.0	64.5	64.3	64.7	65.0	66.3	66.1	-1.5	-0.2	+0.4	+0.3	+1.3	-0.2
Computation	14	70.4	68.3	68.4	69.0	69.6	71.5	71.5	-2.1	+0.1	+0.6	+0.6	+1.9	-0-
Application	12	60.9	60.0	59.5	59.6	59.7	60.2	59.9	-0.9	-0.5	+0.1	+0.1	+0.5	-0.3
Decimals	22	71.8	71.2	72.0	72.9	73.7	75.8	75.8	-0.6	+0.8	+0.9	+0.8	+2.1	-0-
Computation	14	74.1	73.8	74.8	75.8	76.7	79.1	79.2	-0.3	+1.0	+1.0	+0.9	+2.4	+0.1
Application	8	67.8	66.6	67.2	67.7	68.3	70.1	69.9	-1.2	+0.6	+0.5	+0.6	+1.8	-0.2
Algebra	32	62.9	62.1	61.8	62.1	62.3	63.5	63.2	-0.8	-0.3	+0.3	+0.2	+1.2	-0.3
Computation	14	66.4	65.9	65.5	66.0	66.4	67.6	67.5	-0.5	-0.4	+0.5	+0.4	+1.2	-0.1
Application	18	60.1	59.2	58.8	59.1	59.1	60.2	59.9	-0.9	-0.4	+0.3	-0-	+1.1	-0.3
Geometry	24	62.7	62.1	61.8	61.8	62.0	62.4	62.4	-0.6	-0.3	-0-	+0.2	+0.4	-0-
Knowledge of facts	12	75.2	75.5	75.5	75.4	75.5	76.0	76.0	+0.3	-0-	-0.1	+0.1	+0.5	-0-
Application	12	50.1	48.7	48.1	48.3	48.4	48.8	48.8	-1.4	-0.6	+0.2	+0.1	+0.4	-0-
Measurement	30	60.5	59.5	59.4	59.0	59.2	60.0	59.3	-1.0	-0.1	-0.4	+0.2	+0.8	-0.7
Knowledge of facts	12	71.6	70.5	70.1	69.7	69.6	70.8	69.7	-1.1	-0.4	-0.4	-0.1	+1.2	-1.1
Application	18	53.1	52.2	52.2	51.9	52.2	52.9	52.4	-0.9	-0-	-0.3	+0.3	+0.7	-0.5
Probability and statistics	14	57.2	56.9	57.3	57.4	57.8	59.2	58.8	-0.3	+0.4	+0.1	+0.4	+1.4	-0.4
Computation	6	57.9	57.6	58.3	59.0	59.6	61.3	61.3	-0.3	+0.7	+0.7	+0.6	+1.7	-0-
Application	8	56.6	56.3	56.5	56.2	56.5	57.6	57.0	-0.3	+0.2	-0.3	+0.3	+1.1	-0.6
Problem solving	62	61.8	60.7	60.6	60.7	60.9	61.7	61.3	-1.1	-0.1	+0.1	+0.2	+0.8	-0.4
Arithmetic	28	68.5	67.2	67.1	67.2	67.5	68.3	67.9	-1.3	-0.1	+0.1	+0.3	+0.8	-0.4
Graphs	34	56.2	55.4	55.2	55.3	55.4	56.2	55.7	-0.8	-0.2	+0.1	+0.1	+0.8	-0.5

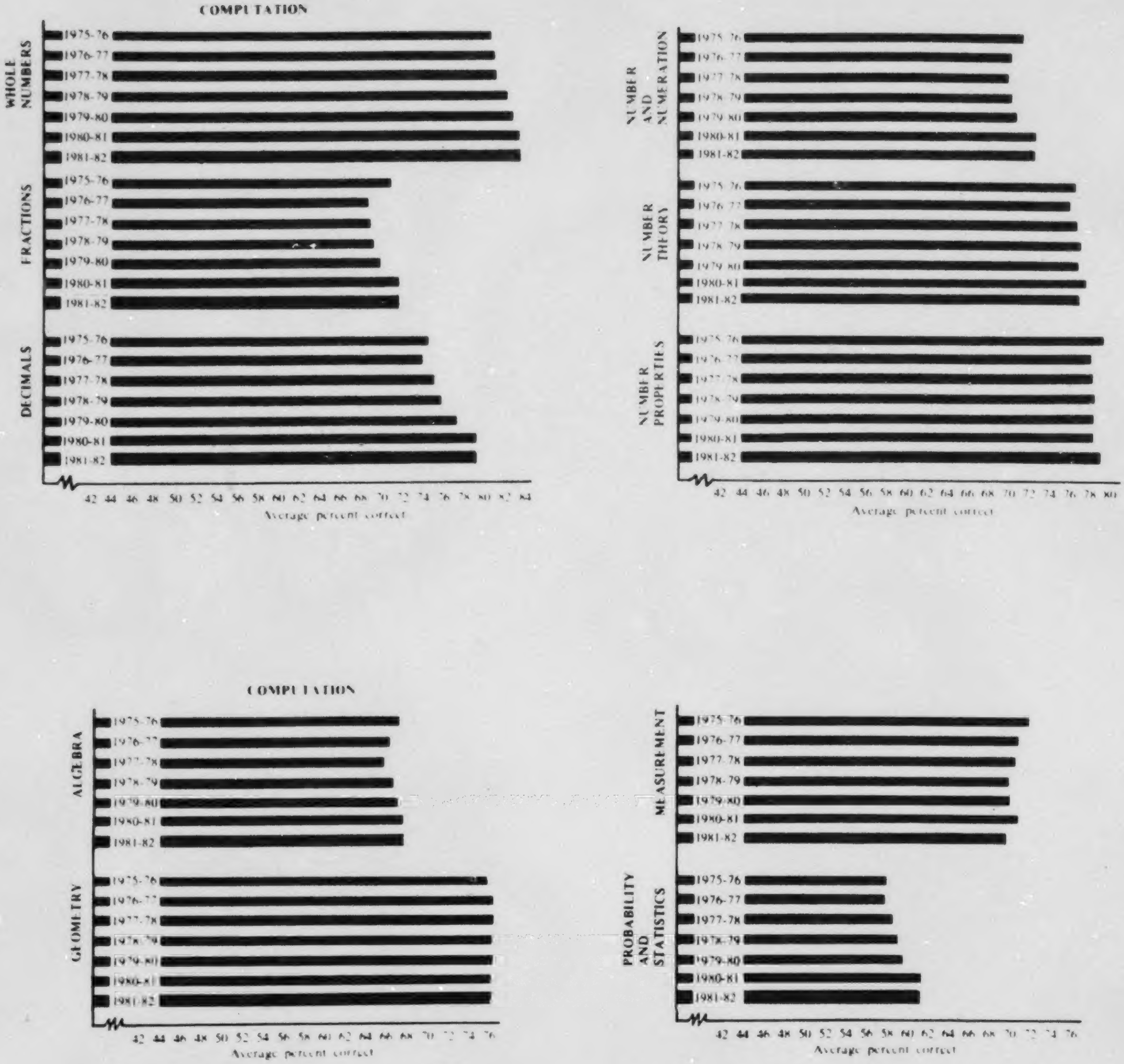


Fig. 28. Graphic representations of percent correct scores of twelfth grade students in computational skills on the *Survey of Basic Skills: Grade 12,* 1975-76 through 1981-82

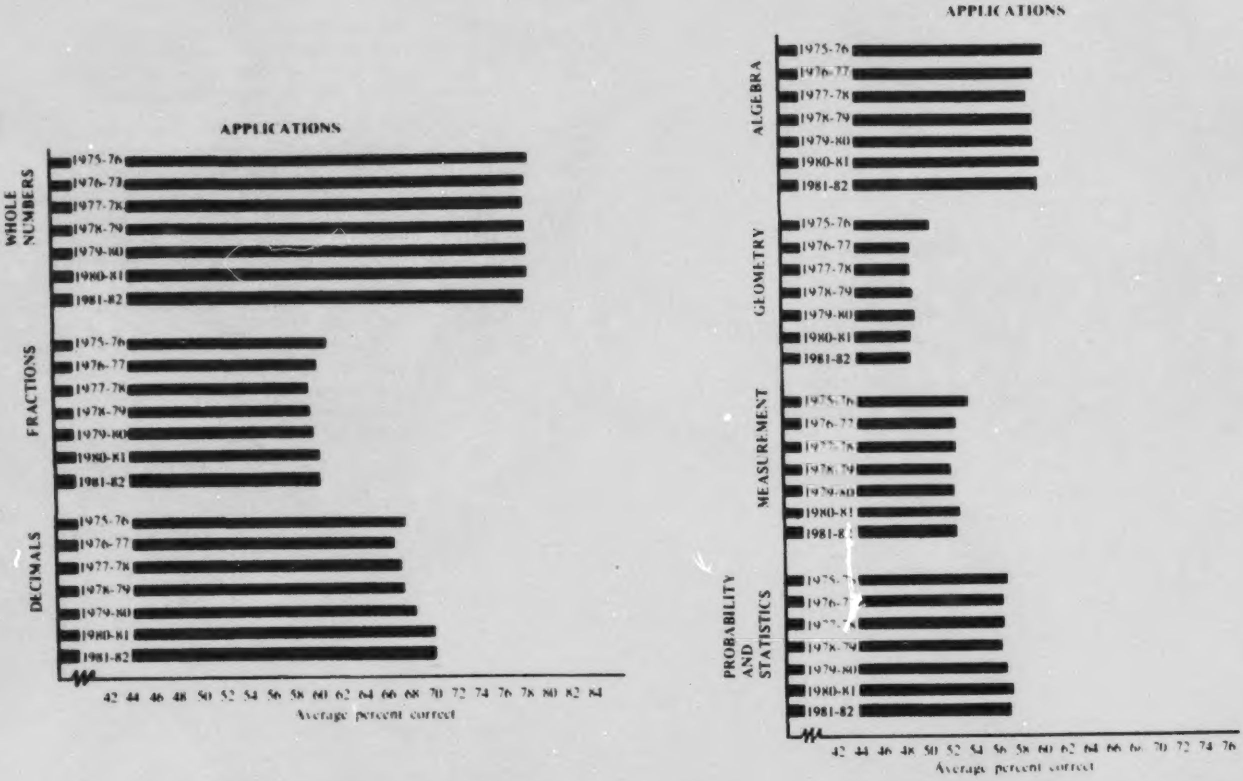


Fig. 29. Graphic representation of percent correct scores of twelfth grade students in application skills on the *Survey of Basic Skills: Grade 12,* 1975-76 through 1981-82

The Committee's Conclusions

The members of the Mathematics Assessment Advisory Committee were disappointed to see the slight decrease (0.3 percent) in the overall math score in 1981-82 after a three-year upward trend. However, they did note that, in general, the skill scores in 1981-82 were the second highest scores in the seven-year testing period and that they were surpassed only by the 1980-81 scores.

The committee members identified areas of strength and areas in need of improvement. The areas of strength included those skills in which the students achieved at or above the committee's level of expectation. The areas in need of improvement included the skills that committee members would like to have particularly emphasized in the classrooms through a variety of instructional methods.

Areas of strength

- Identification of numerals described in words
- Number line concepts
- Expanded notation for whole numbers
- Numbers represented in exponential or repeated multiplication form
- Addition of whole numbers
- Subtraction of whole numbers with or without renaming
- Division of whole numbers
- Multiplication of whole numbers
- Applications involving division facts
- Subtraction of fractions with like denominators
- Addition, subtraction, and multiplication of decimals
- Reading coordinates of points in a coordinate plane
- Obtaining data from simple line graphs and pictographs
- Recognition of common geometric figures and knowledge of geometric facts
- Identification of appropriate units for area measure
- Understanding of the concept of "average"

Areas in need of improvement

- Scientific notation
- Conversion of fractions to decimals
- Order relation for numbers written in fraction form
- Operations with negative numbers
- Multiplication of numbers written in mixed numeral form
- Fraction application problems involving ratio and proportion
- Changing of decimals to percents
- Translation of verbal statements into algebraic expressions
- Interpretation of data read from graphs or tables
- Substitution of given data in given formulas
- Recognition of perpendicular and parallel relationships
- Similarity relationship and use of the Pythagorean theorem
- Knowledge of the symmetry relationship
- Applications involving measurement
- Determination of the median of a given list of numbers
- Applications involving the probability of simple events

A detailed description of these skills is given in Test Content Specifications for the Survey of Basic Skills: Mathematics, Grades Six and Twelve. Illustrative test questions and the performance of students on those questions can be found in the California Assessment Program's Student Achievement in California Schools: 1979-80 Annual Report (Sacramento: California State Department of Education, 1980).

Longitudinal Changes: Grade Six to Grade Twelve

The mathematics scores of twelfth grade students in 1981-82 are of particular interest. These students were the first group tested at the sixth grade level in 1975-76. From information derived from mobility studies, it is estimated that more than 80 percent of the students in this group were tested at both grade levels. The two tests included 16 common items. The scores of this same set of students for these common items are shown below:

Table 14

Type of item	Grade six, 1975-76	Grade twelve, 1981-82	Growth from Sixth to Twelve Grade
Whole number subtraction	76.3	88.2	11.9
Whole number division	77.0	93.1	16.1
Reading of whole numbers	94.2	96.9	2.7
Identifying whole numbers described in words	89.8	95.4	5.6
Fraction multiplication	50.7	72.4	21.7
Fraction application	52.1	75.1	23.0
Decimal application	29.4	71.1	41.7
Decimal addition	91.3	94.6	3.3
Metric conversion	37.8	70.2	32.4
Measurement application	52.1	79.1	27.0
Number line	80.4	95.5	15.1
Number property	43.2	65.2	22.0
Prime numbers	42.7	61.9	19.2
Subtraction of denominate numbers	44.1	71.9	27.8
Probability	49.8	75.9	26.1
Probability	36.1	71.1	35.0
AVERAGE	59.2	79.9	20.7

On these 16 common items, the students' scores increased about 20.7 percent correct from grade six to grade twelve. The scores increased on items from all skills. Since whole number skills are attained at the mastery level in the sixth grade, growth from grade six to twelve is least on such skills. Most growth is seen on skills such as probability, metric units, fraction, decimal, and measurement applications.

The Committee's Recommendations

The members of the Mathematics Assessment Advisory Committee made the following recommendations for further improvement of the mathematics results for twelfth grade students:

- Increased instructional emphasis should be given to solving application problems involving fractions, mixed numbers, and ratios.

- Increased instructional emphasis should be placed on using measurement instruments to understand measurement concepts and applications, since these skills are such vital parts of the basic skills needed in everyday life.

- Continued development of problem analysis and problem-solving skills should be emphasised strongly, since the ability to do only basic computations will not be useful unless the student also knows how to determine what to do, what is known and unknown, and how to interpret the results of computations in practical problems.

- Some elementary algebraic skills are useful in formulating and solving problems. All students should be given the opportunity to acquire these skills before they graduate from high school. Such skills include solving simple algebraic equations, evaluating simple expressions and formulas, and reading and interpreting information from coordinate graphs.

- Students should take at least one year of mathematics in the eleventh or twelfth grade so that instruction in mathematical skills and concepts is provided closer to the time when many students graduate and become working citizens in their communities.

VI. Comparisons with National Norms

Synopsis of Findings

- California third graders have been above the national average for several years. The median California student is now at the 60th, 56th, and 55th percentiles in reading, language, and mathematics.

- California sixth graders have been above the national average since 1976. The median student is now at the 58th, 57th, and 58th percentiles in reading, language, and mathematics.

- Twelfth graders in California were near the national average in 1969 when testing began. They declined sharply during the early seventies; their decline started to slow in the mid-seventies and to flatten out in the late seventies. Students in other parts of the nation also declined during the seventies. Thus, when compared to more recent national test norms, seniors scored only slightly below or a little above those averages, depending on the particular national norm sample used.

Some of the difficulties in using publishers' national norms to judge the adequacy of the performance of California students are discussed in Chapter II. Briefly, the two main problems are (1) lack of agreement among publishers' samples; and (2) lack of timeliness. Any comparison based on a single publisher's norm group (a national sample of students tested at a given time) can be quite misleading and is a tenuous undertaking at best. Since no test is given nationwide, one must rely on various publishers' estimates of the nationwide distribution of test scores. These estimates vary from publisher to publisher and are clearly "guesstimates." Part of the problem in establishing norms is that publishers are dependent upon the good will and cooperation of the districts they select to administer their tests. When the districts that have been carefully selected as part of a national sample decline to participate in the norming study, the results become that much more uncertain. In addition, because of the expense involved, publishers are not able to update their norms more than once every five to eight years.

To cope with this situation, the Department's plan provides for the comparison of the performance of California students with the norms of a variety of tests and updates the comparisons whenever the tests are renormed or when new tests become available. This is done by giving a sample of California students both the publisher's standardized test and the California test. In some cases no extra testing is required. Scores for a publisher's standardized test are simply collected from the school districts that administered the test to all of their students in certain schools for other purposes. The statistical techniques used to equate the two tests are briefly described in Appendix H of the 1978-79 report. The result of this type of "equating study" is to show how California students would have compared to a national norm group if, in fact, all California students had taken the published test.

This approach has several advantages: (1) the national comparisons are more timely since they can be updated as new norms become available; (2) the estimates are more stable since they do not depend on the representativeness of a single publisher's sample; and (3) the progress of California students can be assessed with a test that fits the objectives of the instructional program and simultaneously, with no additional testing, can be compared to national norms.

The comparisons presented in this report are based on the tests with the most recent national norms. This report also contains the results of earlier equating studies so that the reader can inspect the long-term (from 13 to 16 years) achievement test trends in California against the backdrop of national norms.

Grade Three

Table 15 contains the estimated national percentile ranks of the median score of California third grade students' performance on the reading tests since 1966-67. The trend over the years is clearly one of growth, with the third grade reading scores increasing from the 34th to the 38th percentile rank on the Stanford Reading Test, reaching the 52nd on the Cooperative Primary Reading Test, and now increasing from the 55th to the 60th on the Comprehensive Tests of Basic Skills (CTBS). In written language and math the estimated percentile ranks are 56 and 55. Figure 30 is a pictorial display of these trends.

The following outline should help the reader understand more fully the national comparisons.

1. The third grade results for 1966-67 through 1970-71 were based on the Stanford Reading Test, which was administered to all third grade students in California. The norms for the Stanford Reading Test were established in 1963. Thus, the gains that occurred each year are relative to those norms.

2. The third grade results for 1971-72 through 1972-73 were based on the Cooperative Primary Reading Test (CPRT), which was administered to all third grade pupils in California. The norms for the CPRT were established in 1966. The dramatic increase of scores in the changeover years was due largely to the great differences between the norms of the Stanford Reading Test and those of the CPRT.

3. In 1973-74 the California Assessment Program developed the Reading Test. A systematic sample of one-ninth of all students tested in grade three was used in an equating study to estimate the performance of the median pupil in California relative to 1966 Cooperative Primary Reading Test norms. The results indicated little change from those of the previous years.

4. In 1974-75 the Reading Test was revised and administered to all third grade students in California. The same test was used in 1975-76, 1976-77, 1977-78 and 1978-79. The results of an equating study were used to estimate the performance of California students in comparison to the norms established in 1973 for the Comprehensive Test of Basic Skills (CTBS), Form S. As a result of the modest increases in the third grade scores, the median score of California pupil performance in grade three in 1978-79 was at the 58th percentile of CTBS 1973 norms.

5. In 1979-80, the new Survey of Basic Skills: Grade 3 was administered to all third grade students in California public schools and equated to the Comprehensive Tests of Basic Skills (CTBS). The same test was administered in 1980-81 and 1981-82. The median California student is estimated to be at the 60th percentile in reading, the 56th percentile in written language, and the 55th in mathematics.

Grade Six

The performance of sixth graders in California declined in the early 1970s and leveled off by 1974. It has climbed steadily since then. Table 16 shows that the median California sixth grade student's performance in 1981-82 was slightly above the national sample tested in 1973 by the makers of the Comprehensive Tests of Basic Skills. Figure 31 is a graphic representation of these trends. Reading performance has a percentile rank of 58; language, 57 and mathematics, 58.

A more complete description of these findings is given below:

1. From 1969-70 to 1973-74 the Comprehensive Tests of Basic Skills (Form Q, 1968 norms) was administered to all California sixth grade students. During this period the performance of California students declined from four to nine percentile ranks on the basis of the 1968 norms.

2. In 1974-75 the first version of the California Assessment Program test, the Survey of Basic Skills, was administered statewide. An equating study conducted that year showed that scores had improved and that if the Comprehensive Tests of Basic Skills had been administered statewide, the percentile ranks would have gone up to 48, 43, and 44 for reading, language, and mathematics, respectively.

3. A revision of the survey was administered in 1975-76, 1976-77, 1977-78, 1978-79, 1979-80, 1980-81, and 1981-82. An equating study showed that on the basis of the 1973 version of the CTBS, California students improved enough in 1975-76 to equal or exceed the national average in reading and mathematics. Following the upward trend of earlier years, the 1981-82 improvement in language and mathematics achievement boosted the percentile ranks to 57 and 58 respectively. The percentile rank for reading moved up to the 58th percentile.

Grade Twelve

The performance of twelfth grade students in California declined consistently during the seventies, since testing began in 1969-70. By 1976-77 the median high school senior was at the 42nd, 33rd, and 43rd percentile ranks in reading, written expression, and mathematics, respectively, on the basis of the Iowa Tests of Educational Development with its 1962 norms. On the basis of tests with more recent norms (1970) the ranks were even lower (see Table 17 and Figure 32).

Comparisons with National Norms

Whereas progress in the last years was noticeable but spotty, the gains made in 1980-81 were more uniform and substantial. Reading moved up to the 42nd, 33rd, and 35th percentile ranks on the tests used to establish national comparisons with 1962 and 1970 norms. Written expression scores moved up to 35, 29, and 30. The improvement in mathematics was largest of all, increasing the national percentile ranks to 46, 44, and 47.

The results for 1981-82 were mixed. Students improved in two of the areas (written language and spelling) and declined in two areas (reading and mathematics). Since the changes in all areas were quite small, only one of the national percentiles was affected: reading moved from the 33rd to the 32nd percentile rank on the Tests of Academic Progress.

Each of the three tests were renormed on new national samples in 1978. National performance declined during the 1970s. When California students are compared to this new norm, their relative standing is higher than when compared to the 1962 and 1970 national norm samples.

Table 17 includes the specific comparisons with these more recent norms. It can be seen that this decline in national performance gives California a higher standing in all but one case. The latest ranks place California students near but still slightly below the norms on the ITED and the TAP. On the STEP, California is above the newer national averages in both language and mathematics.

Scholastic Aptitude Test (SAT) Results

The results of the California Assessment Program are the only indicators of the level of learning of all California public high school students. The results of the Scholastic Aptitude Test, a nationally administered college admissions test, however, have received considerable attention from the press over the last decade or so. Although the SAT results represent only a select sample of California students, they have followed a pattern similar to that of the CAP scores. They are presented here for the reader's convenience in using both sets of results to judge the educational progress of high school students.

There are a variety of advantages and disadvantages of employing the SAT results as a basis for making inferences about the effectiveness of the educational system. The key point on the positive side is that the test results can be traced over a long period of time; although the test items are changed and updated, the common 200-800 score scale allows for valuable longitudinal comparisons.

The chief disadvantage is that only a sample of all students take the SAT. The real problem in interpreting the scores is that one never knows how representative the California and national samples are. They obviously are not representative of all students, and they may or may not be representative of the college-bound population. In California about 36 percent of the seniors take the SAT, whereas nationally about 33 percent are tested. Equally important is the fact that the test reflects almost exclusively the more advanced, higher-level thinking skills in the areas of language and mathematics. This is, of course, very logical given the purpose of the test--to predict how well students will succeed in college. It just means that one cannot judge, from this information, the total effectiveness of schools in reaching their various aims, especially as those aims pertain to the other two-thirds of the high school population.

Figure 33 shows the national trends for the verbal and mathematics parts of the SAT going back to 1960. Table 18 gives the specific scores. It can be seen that the much-publicized decline began in 1963. Test results for individual states became available from the College Board in 1972. Figure 33 also shows the trend for California seniors since that time. It can be seen that California seniors were above the national average (but not necessarily all other states) in the early seventies but were declining more rapidly than the rest of the United States.

During the mid-seventies, both California and the national average began to level off. In 1978, the trend lines began to diverge again; the national average was still slowly declining, whereas the California trend line moved clearly above the national average in math (to a nine-point lead in 1981) and slightly above on the verbal part (a two-point lead).

In 1982, the national averages improved for the first time in 19 years; one point in mathematics and two points on the verbal part of the test. The California gains were not maintained; the averages declined one point on each part of the test. Chapter VII contains additional information related to the SAT results for California students.

TABLE 15

ESTIMATED NATIONAL PERCENTILE RANKS OF MEDIAN CALIFORNIA PUPIL PERFORMANCE 1966-67 THROUGH 1981-82

Grade Three

Content area	Test administered															
	Stanford Reading Test					Cooperative Primary Reading Test		Reading Test[a]	Reading Test[b] (Revised)					Survey of Basic Skills[c]		
	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
Reading	34	34	36	36	38	52	52	52	55	55	56	57	58	58	59	60
Language	--	--	--	--	--	--	--	--	--	--	--	--	--	53	54	56
Mathematics	--	--	--	--	--	--	--	--	--	--	--	--	--	51	52	55
Norms:	*Stanford*, 1963 norms					*CPRT*, 1966 norms			*CTBS*, 1973 norms							

[a] The *Reading Test* was first administered in 1973-74. The percentile ranks are based on an equating of the *Reading Test* and the *Cooperative Primary Reading Test*, forms 23A and 23B, normed in 1966.

[b] The revised *Reading Test* was administered to all California students in 1974-75, 1975-76, 1976-77, and 1978-79. The percentile ranks are based on equating studies of the revised *Reading Test* and the *Comprehensive Tests of Basic Skills*, Form S, normed in 1973.

[c] The new *Survey of Basic Skills: Grade 3* was administered to all California students in 1980-81 and 1981-82. The estimated national percentile ranks are based on an equating study of the new test and the *Comprehensive Tests of Basic Skills*, Form S, normed in 1973.

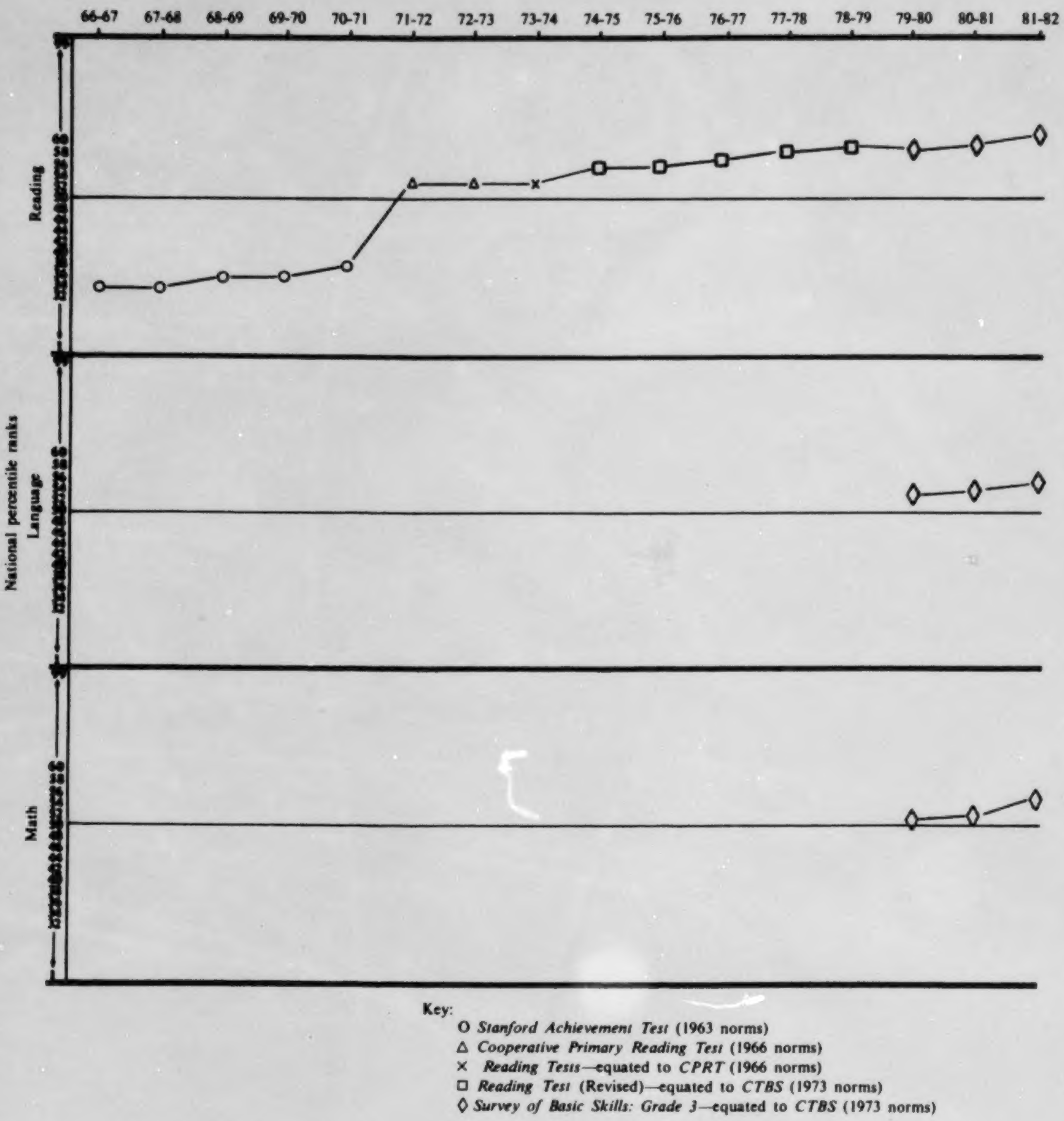


Fig. 30. National percentile ranks of median third grade California student performance, 1966-67 through 1981-82 for reading and 1979-80 through 1981-82 for written language and math

TABLE 16

ESTIMATED NATIONAL PERCENTILE RANKS OF MEDIAN CALIFORNIA STUDENT PERFORMANCE
1969-70 THROUGH 1981-82

Grade Six

Content area	Test administered												
	Comprehensive Test of Basic Skills					Survey of Basic Skills[a]	Survey of Basic Skills[b]						
	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
Reading	48	46	44	44	44	48	53	53	55	55	56	57	58
Language	43	43	39	39	37	43	49	51	51	52	53	55	57
Mathematics	47	43	38	38	38	44	50	51	53	54	55	56	58
Norms:	CTBS, 1968 norms						CTBS, 1973 norms						

[a] The new California test, the Survey of Basic Skills: Grade 6, was first administered to all California pupils in 1974-75. The percentile ranks are based on an equating of the Survey of Basic Skills and the Comprehensive Tests of Basic Skills (CTBS), Form Q, which was normed in 1968.

[b] The revised version of the Survey of Basic Skills: Grade 6, was administered from 1975-76 through 1980-81. A second revision of the test was administered in 1981-82. The percentile ranks are based on equatings of the revised versions of the Survey of Basic Skills and the Comprehensive Tests of Basic Skills (CTBS), Form S, 1973 edition.

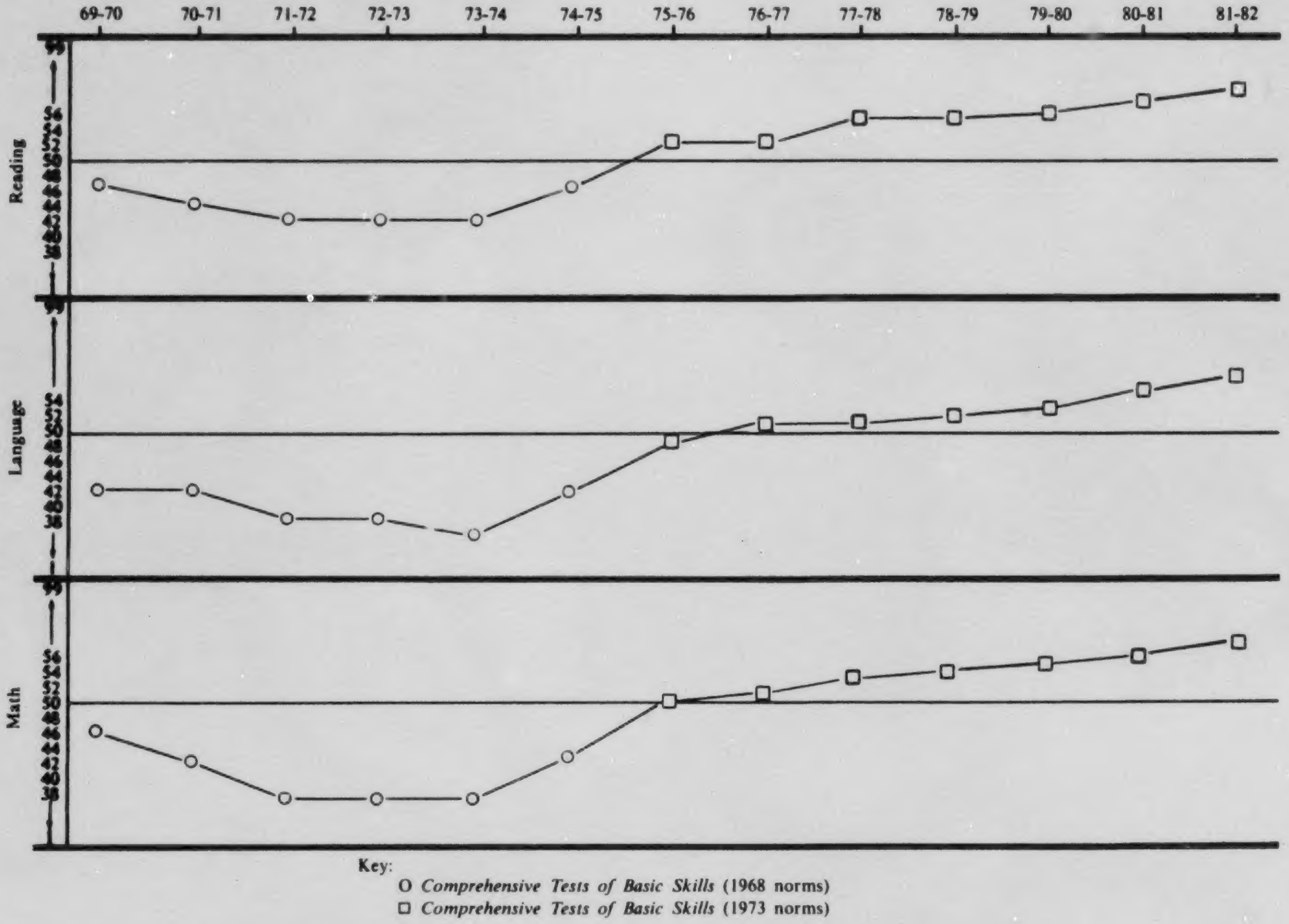


Fig. 31. National percentile ranks of median sixth grade California student performance, 1969-70 through 1981-82

TABLE 17

ESTIMATED NATIONAL PERCENTILE RANKS OF MEDIAN CALIFORNIA STUDENT PERFORMANCE 1969-70 THROUGH 1981-82

Grade Twelve

Content area	Test administered												
	Iowa Tests of Educational Development Form X, normed in 1962					Survey of Basic Skills[a]	Survey of Basic Skills[a] (Revised)						
	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
Reading													
ITED, 1962 norms	52	49	49	47	47	41	43	42	42	41	41	42	42
1978 norms												44	44
TAP, 1970 norms						33	35	33	32	32	32	33	32
1978 norms												42	42
STEP, 1970 norms						34	38	36	35	34	34	35	35
1978 norms												47	47
Language													
ITED, 1962 norms	42	40	38	36	34	32	34	33	34	34	34	35	35
1978 norms												43	43
TAP, 1970 norms						25	27	26	26	27	27	29	29
1978 norms												40	41
STEP, 1970 norms						27	29	28	28	28	28	30	30
1978 norms												57	57
Mathematics													
ITED, 1962 norms	48	48	48	48	48	41	44	43	43	43	44	46	46
1978 norms												46	45
TAP, 1970 norms						38	43	41	41	41	42	44	44
1978 norms												41	41
STEP, 1970 norms						41	44	43	43	43	43	47	47
1978 norms												55	55

[a] The new California test, the Survey of Basic Skills: Grade 12, was administered to all California students from 1974-75 through 1981-82. The percentile ranks are based on equating studies of the Survey of Basic Skills and three other tests with national norms: (1) Iowa Tests of Educational Development, normed in 1962 and 1978; (2) Tests of Academic Progress, normed in 1970 and 1978; and (3) the Sequential Tests of Educational Progress, normed in 1970 and 1978.

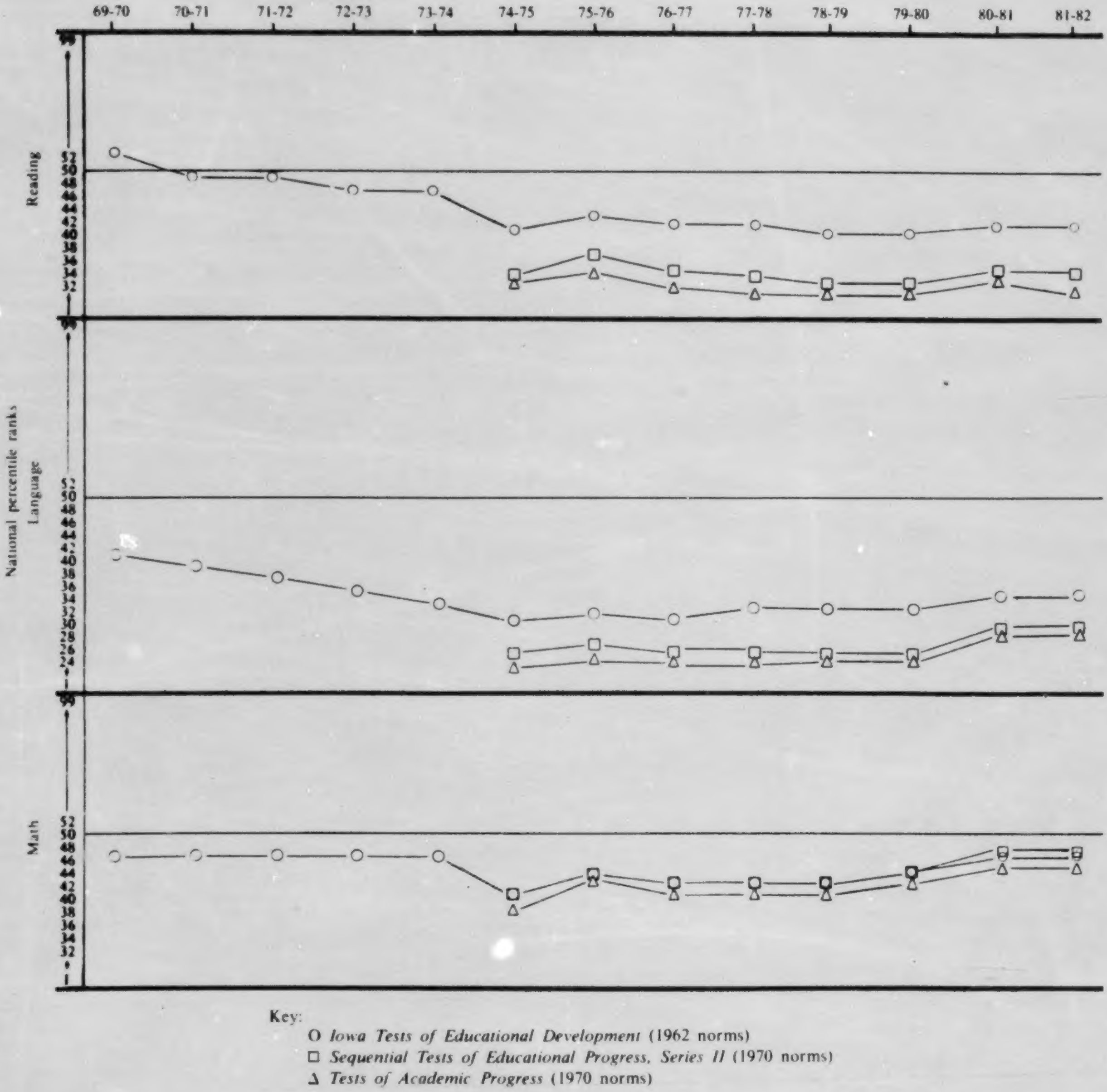


Fig. 32. National percentile ranks of median twelfth grade California student performance, 1969-70 through 1981-82

TABLE 18

SCHOLASTIC APTITUDE TEST SCORES (SAT)
1971-72 THROUGH 1981-82

Year	Verbal				Mathematics			
	Male	Female	Total	Year to Year Difference	Male	Female	Total	Year to Year Difference
California:								
1971-72	466	462	464		518	467	493	
1972-73	456	448	452	-12	511	460	485	- 8
1973-74	454	446	450	- 2	509	460	484	- 1
1974-75	440	431	435	-15	501	446	473	-11
1975-76	434	426	430	- 5	500	443	470	- 3
1976-77	431	424	427	- 3	500	443	470	0
1977-78	432	423	427	0	496	440	466	- 4
1978-79	432	424	428	+ 1	502	447	473	+ 7
1979-80	429	420	424	- 4	500	446	472	- 1
1980-81	434	419	426	+ 2	503	449	475	+ 3
1981-82	431	420	425	- 1	503	448	474	- 1
National:								
1971-72	454	452	452		505	461	484	
1972-73	446	443	445	- 8	502	460	481	- 3
1973-74	447	442	444	- 1	501	459	480	- 1
1974-75	437	431	434	-10	495	449	472	- 8
1975-76	433	430	431	- 3	497	446	472	0
1976-77	431	426	429	- 2	497	445	470	- 2
1977-78	433	425	429	0	494	444	468	- 2
1978-79	431	423	427	- 2	493	443	467	- 1
1979-80	428	420	424	- 3	491	443	466	- 1
1980-81	430	418	424	0	492	443	466	0
1981-82	431	421	426	+ 2	493	443	467	+ 1

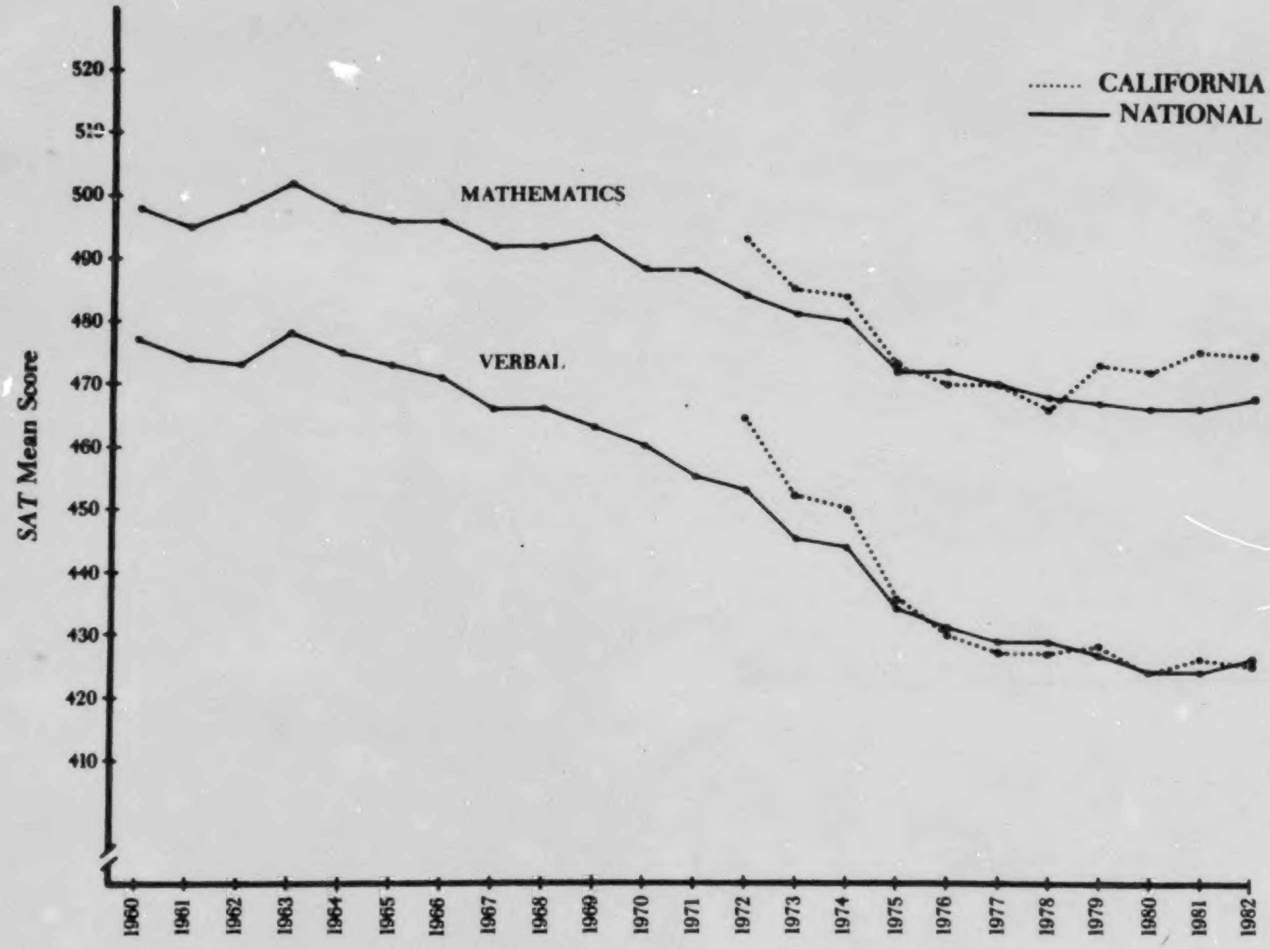


Fig. 33. Scholastic Aptitude Test (SAT) scores for high school seniors in California, 1972 (first year available), and the United States, 1960 through 1982

VII. Time and Learning in California Schools

Synopsis of Findings

- Total instructional time in California is the equivalent of:
  - One-half year less than nationwide by the end of grade three;
  - One and one-third years less than nationwide by the end of high school.
- In grade six, of the five hours of total instructional time:
  - Half is spent on the basics: reading (61 minutes), writing/language (47 minutes), and mathematics (53 minutes);
  - One-fifth is spent on science (25 minutes) and social studies (36 minutes).
- More time is spent on reading in schools serving low socioeconomic populations, and this time is taken away from writing/language, science, and social studies, but not from mathematics.
- High school seniors, over their four years of high school, average 3.8 years of English, 2.8 years of mathematics, 2.1 years of science, and 1.5 years of foreign language instruction.
- Twenty-nine percent of high school seniors have had no foreign language instruction.
- National achievement data suggest small advantages for California students in basic reading and mathematics skills and in initial college preparatory mathematics.
- The number of science and mathematics courses taken by college-bound high school seniors in California is far under the average for high school seniors nationwide.
- Although California seniors take the *Scholastic Aptitude Test* at the same rate as seniors nationwide, they take the achievement battery at a much higher rate. However, they take the science achievement test at less than half the national rate. This reinforces the findings on differences in course taking.
- Achievement levels in biology and chemistry among college-bound high school seniors in California fall below national levels even after accounting for the more highly selective course entry.

Time and Learning in California Schools

INTRODUCTION

A recent survey of elementary and secondary schools by a California school superintendent (Anton, 1981) concluded that California pupils are offered less schooling than pupils nationwide. This finding stirred concern because of its obvious implication that less schooling results in lower achievement.

The annual reports of the California Assessment Program have presented information to educators and policymakers on a variety of factors associated with school success, most notably and recently, the relationship between television viewing and achievement. This practice helps fulfill one aspect of the legislative intent of the testing program: "The program of statewide testing shall identify unusual success or failure and the factors which appear to be responsible, so that appropriate action may be taken at the district and state level to obtain the highest quality education for all public school pupils." (Section 60601) The focus of this year's report will be upon the amount and use of instructional time in California schools.

The search for effective schools and the identification of their common (causal?) characteristics has been widespread and fruitful. One summary of the common elements found in schools which seem to produce consistently higher achievement than their peers is given in the appendix to this chapter. The characteristics listed fit the common sense notion of what "good" schools, or other social institutions, are like. The problem is one of replication, how can other schools be helped to follow their lead. Many, if not most, of their characteristics are related to the personalities of the people involved. Personalities are not easily changed.

The recent focus on instructional time and its transformation into "active learning time" or "time-on-task" has provided policymakers a tangible and potent lever for improving school achievement. Time is the portal through which all learning must pass and all resources and efforts aimed at improved learning must directly or indirectly impinge on learning time.

If it is true that California pupils have shorter school years and shorter school days, then there is less time to learn and consequently pupils will achieve less. This argument tacitly assumes that learning time made available to pupils is relatively homogenous in content and productivity. That is, it assumes that an hour of schooling generally results in a similar amount of learning nationwide for comparable pupils. That assumption could be justified if resource allocations and uses in the nation's schools were quite similar, so that teaching-learning processes in particular grades would show only negligible variations nationwide. But actually, this is not the case.

Typically, resource allocation is measured in terms of per student expenditures and resource use is characterized by indicators representing the organization of schooling, such as school and class size, teaching strategies, and curricular policies and goals. All of these factors vary widely, and they do matter for student learning. They strongly influence the major vehicles carrying students' achievements, i.e., the amounts and contents of their active learning time.

Time and Learning in California Schools

It is beyond the scope of this chapter to present a comprehensive picture of the productivity of California schools. Such an analysis would require much more data, for California and the nation, than is now available on the variety of ways that different types and levels of resources are allocated to various kinds of goals for different types of students. It is hoped that the information in this chapter will, however, provide useful, albeit limited, information about the allocation of one scarce resource: time, and how California schools compare with the nation in their handling of that resource.

Designed to accomplish this goal, the chapter is organized in the following sections:

- A review of the research focus on instructional time and active learning time;
- A comparative analysis of the amount of time allocated to learning in California schools;
- An analysis of how that time is allocated to different subject areas and courses;
- The relative impact on student achievement of those time allocation patterns and;
- A brief discussion of some ways that California student achievement can be raised.

Instructional Time and Active Learning Time

The past ten years of research on schooling have strikingly shifted attention toward the uses of resources--especially teaching time--and their consequences for learning (see Wiley and Harnischfeger, 1974). Much of the conceptual underpinnings of this work are due to Carroll (1963) and have been extended by Bloom (1976) and Harnischfeger and Wiley (1976, 1978, 1983). Important empirical results as well as conceptual summaries may be found in Denham and Lieberman (1980) and Fisher and Berliner (1983).

Key words and phrases that are used, especially in the empirical literature, to describe students' relations to the teaching-learning process include "on-task - off-task," "engaged - unengaged," "attentive - inattentive," and "active - inactive." These terms are attempts to invoke the psychological precept that in order to learn, an individual needs to respond actively. Fundamentally, this notion is based on the conception that all learning consists of acquiring capacities to perform tasks. When learning is intentional, these capacities are often acquired by practicing and mastering those tasks, or simplified versions of them or parts of them (subtasks). Such tasks are usually then called "learning tasks." Learning tasks, as any other tasks, must be "performed" and, therefore, activity by the learner--in some form--is mandatory. To paraphrase Tyler (1949), to learn to do, one must do.

Thus, active learning time, time-on-task, or engaged learning time, and related terms such as academic learning time, opportunity to learn, and allocated learning time, have become concepts that have redirected much of the earlier research on school and teaching effectiveness to focus on the teaching-learning process and its determinants. This research has led to one simple but profound insight: A student's time-on-task, or active learning time, determines his or her achievements.

This research implies that there are only four ways to increase achievement (Harnischfeger and Wiley, 1983). One is via a reduction in the time needed to learn. All the others depend on increasing active learning time. These latter three routes consist of:

- Increasing the total amount of time allocated to learning;
- Increasing the portion of that allocated time that is actually allowed for learning;
- Increasing the amount of this allowed time that students actively devote to learning.

The primary focus of studies of total school time--day length and year length--is on the quantity of time available, not its use. The use of that time determines what is learned and how it is learned, thus directly influencing active learning. This total time is allocated to particular subject areas, learning topics, and learning tasks. Only the time made available for these activities may be used for learning, and time not available for learning can never result in actual learning.

Are California Students Offered Less Time to Learn?

The results of Anton's survey may be disregarded if their accuracy is in question. If, however, Anton's results are supported by other data collections of known accuracy, then the implications of less school time to learn in California are worthy of consideration.

Anton's estimates of scheduled instructional time are compared to those found in a national study of known high accuracy (National Institute of Education, 1978). These 1976 data closely correspond to Anton's national time estimates (Table 19), as does CAP's sixth grade survey, made one year later than Anton's (1981-82 vs. 1980-81). CAP collected from school officials information on subject-matter time allocation, as well as on practices and policies concerning time allocations. CAP's data collection resulted in an even slightly lower estimate of instructional time allocation than Anton's. Sixth graders' daily scheduled instruction is estimated as slightly greater than five hours in Anton's 1980-81 survey (308 minutes), while the average is just about five hours (299 minutes) in the 1981-82 CAP survey.

A comparison of CAP's estimate for sixth graders in California to Anton's 1980-81 nationwide estimate, with consideration given to the shorter school year in California, shows that sixth graders in California are offered 93 hours less schooling than sixth graders nationwide.[1] This is equivalent to 19 instructional days, or nearly one month of schooling.[2] This difference is substantial and consistent--the daily scheduled instructional times for all grades in California are systematically shorter than those in the nation as a whole.

Table 19

Mean Daily Minutes of Instruction and Length of School Year for California and the Nation, by Grade

Grade	Nation		California	
	1975-76*	1980-81**	1980-81**	1981-82***
K	203	191	182	
1	304	310	268	
2	308	311	268	
3	311	314	270	
4	321	322	303	
5	323	323	304	
6	329	326	308	299
7	349	332	308	
8	350	333	309	
9		331	302	
10		332	305	
11		331	305	
12		331	305	
Days per year	177.5	178.5	176.0	

*National Institute of Education, Compensatory Education Study, unpublished tabulations.

**Anton data.

***California Assessment Program, Grade Six Survey, 1981-82.

California high school students also receive less schooling because of fewer periods per day and a shorter school year (Table 20). In each year of high school, students in California, on the average, take 73 hours less coursework than students in the nation as a whole. This is equivalent to 13 school days in California. Thus, over four years of high school, California high school students receive the equivalent of 52 days, or about two and a half months, less schooling than high school students nationwide.

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[1] Total hours are calculated by taking the product of the minutes per day and days per year and dividing that product by 60. This process was carried out for sixth graders in California and the nation, using the figures in Table 19. The resulting discrepancy is 93 hours.

[2] Ninety-three hours divided by five hours per day (299 minutes) equals 19 days.

Table 20

High School Instructional Time, California and the Nation, 1980

Time Component	California	Nation
1. Minutes per period	54.1	52.1
2. Periods per day	6.1	6.7
3. Minutes per day [(1)x(2)]	330.0	349.1
4. Days per year	177.3	180.1
5. Hours per year* [(3)x(4)÷60]	975	1048

*Total High School Instructional time in California is 7.0 percent less than that in the nation according to data from High School and Beyond. According to the Anton survey (Table 19), the corresponding shortfall is 9.2 percent.

Hypothetically, a typical California student's school life, as exhibited in Table 19, from kindergarten through twelfth grade would be 72,000 hours shorter than that of a typical student in the nation; this is the equivalent of one and one-third sixth grade school years. This large discrepancy is the result of shorter instructional days and a shorter school year. California ranks among the ten states with the shortest school year in the nation (Digest of Education Statistics, 1980).

The extent of the differences in amount of schooling shows that relative to the nation, the instructional days in California are especially short in the primary grades (K-3). By the end of grade three, California students have been offered one-half year less schooling than students nationwide. The yearly discrepancies in later grades are somewhat smaller, but they consistently increase the cumulative shortfall. The question remains whether California students achieve less than students nationwide or whether the learning productivity per time unit is higher in California than nationwide, assuring equivalence of student achievement. A comparison of subject-matter time allocations clarifies how students spend time in school, and a comparison of achievement test scores of California students to those of students nationwide will serve to substantiate the discussion.

How Much of What Are California's Schools Offering?

California students spend less time in school than their counterparts nationwide. But how do learning opportunities in California compare with those of schools across the nation in terms of subject-matter time allocations? Data from the 1981-82 assessment of California sixth graders were compared with data from a national study carried out in 1976-77 (Hinckley et al., 1978), and 1981-82 twelfth grade CAP data from student reports on high school courses taken were compared to national data collected in 1979-80 (High School and Beyond). CAP has further compared California college-bound seniors to college-bound seniors nationwide for the past ten years--the college-bound defined in this chapter as those who took the Scholastic Aptitude Test (SAT).

In an evaluation of these comparisons, it is important to recall that the process by which time is used differs from elementary to secondary schools because of their different organizations. Instruction in elementary schools, especially in the lower grades, takes place primarily in self-contained classrooms; i.e., a single teacher arranges times and sequences of instructional activities. Students are typically grouped for instruction, and the major allocation decisions about how much time to devote to a particular subject area, for a specific group or individual, are left to the teacher in charge. As expected, wide variations result across classes (DeVault, Harnischfeger, and Wiley, 1977).

On the other hand, secondary schools and the upper grades in some elementary schools are departmentalized. This means that the teacher, as an individual, has no control over the gross time allocations for subject areas. Thus, the district and school, by means of course offerings and entry and counseling policies, and the pupil and his or her parents, by their choices within these policies, influence the allocation and use of instructional time.

Sixth Grade Subject Area Time Allocations

The sixth grade time allocations to subject areas are displayed in Tables 21 and 22. Table 21 exhibits national data on minutes per day of instruction offered in reading and mathematics in grades one through six in 1976-77 (Hinckley et al., 1978). The data indicate that nationally the number of minutes per day of reading instruction decreases substantially and continuously from grade one (about one and three-fourth hours) to grade six (about 1 hour). The California data for grade six match those for the nation. In mathematics, the national data are essentially constant (at about an hour per day) across the elementary grades. California mathematics instruction, contrary to the finding for reading, may be shorter than the national average in the sixth grade--4 minutes, or 7 percent, less.

Table 22 shows that in grade six in California the basic skills areas--reading (61 minutes), writing/language (47 minutes), and mathematics (53 minutes)--have the largest time allocations, each approaching an hour on the average. These are followed by social studies (36 minutes), physical education (27 minutes), and science (25 minutes). Art, music, and health trail with about a quarter of an hour each. In total, the average instructional time per day is reported as about 5 hours, and noninstructional time (recess, lunch, and so on) is reported at about 1 hour, yielding a total school day of about 6 hours.

These time allocations are averages in two senses. First, they are the assessment of a school principal or other school official of the typical daily time spent on these subject areas. In a sense, these are "average" values over

Table 21

Mean Daily Minutes of Instruction in Reading and Mathematics, Nationally, by Grade, and California, for Grade Six

	Reading		Mathematics	
Grade	Nation (1976-77)*	California (1981-82)**	Nation (1976-77)*	California (1981-82)**
1	107	-	58	-
2	100	-	59	-
3	86	-	61	-
4	73	-	61	-
5	68	-	61	-
6	62	61	57	53

*Adapted from Hinckley et al., 1978.
**California Assessment Program, Grade Six Survey, 1981-82.

Table 22

Mean Time Allocations, by Subject Area, in California, Grade Six, 1981-82

Subject area	Mean minutes per day
Reading	61
Writing/language	47
Mathematics	53
Science	25
Social studies	36
Art	16
Music	14
Health	16
Physical education	27
Other	7
Total	302*
Total instructional time	299*
Total noninstructional time	67
Total school time (sum)	366
School day length	365

*The sum of the means does not equal the mean of the sums because of adjustments for outlying (obviously incorrect) values.

different school days and over different school classes. Some of this variation is reflected in Table 23: About one half of the schools report that there is little or no variation in subject area time allocations. This report differs, however, depending on school organization. About three quarters of schools with completely departmentalized sixth grades report lack of variation. Logically, the remaining variations in these schools must be over school days rather than classes.

Table 23

Organization of Sixth Grade Classes in California and Reported Variation in Time Devoted to Subject Areas, 1981-82

	Percent of schools by organization of sixth grade classes				
Reported variation in time devoted to subject areas over classes	Self-contained classrooms	Modified self-contained classrooms	Partially departmentalized	Completely departmentalized	All schools
Very much	1	1	1	0	1
Some	39	31	25	14	34
Little or none	46	58	65	76	52
Not sure	1	1	1	0	1
Wide variation in some subjects, not in others	4	5	4	4	4
Only one class per grade	9	4	4	6	8
Total	100	100	100	100	100
Percent of all schools	59	23	15	3	100

Data collected from teachers in other studies (DeVault et al., 1977; Denham and Lieberman, 1980) indicate that the principals' estimates might understate the actual variation--especially the figure of 46 percent for schools with self-contained classrooms. These other studies, which include data from California and other states, indicate that basic skills time allocations may differ by three- or four-to-one across self-contained classes in the same school.

But equality of subject-area time allocations over classes is not necessarily a policy goal in itself, although many districts have such policies in the form of weekly time allocations to subject areas. These policies that define content and/or time allocations obviously are based on the assumption that equal learning results from equal amounts of instructional time for all students. That, of course, is unwarranted. It would be preferable to discuss subject-area time allocations in the context of educational adequacy; i.e., goals of schooling and resources available for specified groups of students. Subject-area time allocations would then be part of the resource allocation process, with students' and schools' educational difficulties being taken into account.

In fact, instructional time allocations vary for students with different socioeconomic backgrounds (Table 24). Using CAP's socioeconomic status (SES) index, we have assessed the sixth grade time allocation data for schools with very low, typical, and very high socioeconomic student backgrounds. We have compared subject-area time allocations for reading, writing/language, mathematics, science, and social studies. Although the total amount of time allocated to these subject areas is the same for all schools, there are sizable differences among types of schools, by subject area. These differences are largest for reading.

Table 24

Time Allocations Across Subject Areas for California Schools Serving Communities of Different Socioeconomic Levels, Sixth Grade

	Instructional time (minutes/day)					
SES percentile	Reading	Writing/ language	Mathematics	Science	Social studies	Total
10	63.0	44.9	56.0	25.9	35.5	225.3
50	60.1	46.1	55.9	26.6	36.4	225.1
90	57.4	47.8	55.7	27.2	37.3	225.4
Difference (10 vs. 90)	+ 5.6	- 2.9	+ 0.3	- 1.3	- 1.8	---
Percent difference	+ 9.3	- 6.3	+ 0.5	- 4.9	- 5.0	---

Schools serving communities of low socioeconomic level (those whose levels exceed only the lowest 10 percent) allocate the largest amount of time to reading (63 minutes per day). Students in these kinds of schools are offered 9 percent more reading instruction than students who are enrolled in schools in communities of high socioeconomic level (those whose levels are exceeded by only the highest 10 percent). Since the total time allocation to the above-named subject areas is the same for all schools, the extra reading time must effect a shorter time allocation in other subject areas. Obviously, mathematics time allocation is not cut. But an increase in time allocation to reading tends to decrease the time allocations to writing/language, science, and social studies, but not to mathematics.

As a part of the supplementary questionnaire, sixth grade principals also indicated their concern for how instructional time is to be used to increase students' active learning time via a number of strategies and special programs they have implemented. CAP's data show that over 80 percent of the schools have some kind of program that is specifically directed toward increasing students' active learning time (Table 25). The most common strategies used involve regrouping students (65 percent), improving discipline (76 percent), staff development (55 percent), improving students' independent work habits (51 percent), and providing better materials (51 percent).

Table 25

Use of Special Programs and Strategies
in California Elementary Schools
to Increase Time Devoted to Instructional Activities

Program strategy	Percent of schools using programs extensively
Making new student groupings	65
Increasing direct teaching	32
Increasing or redirecting aides	44
Providing better materials	51
Improving discipline	76
Reducing class size	15
Changing school schedule	36
Increasing parent involvement	36
Changing classroom schedules	38
Changing physical arrangements	24
Decreasing seatwork	21
Providing staff development	55
Improving independent work habits	51
Providing for cooperative learning and peer teaching	37
Total	81

Some of the strategies used or favored by principals involve redirecting resources; others require additional resources. Reducing class size and increasing parent involvement and staff development require supplementary resources; making new student groupings, increasing direct teaching, and changing classroom schedules are examples of redirecting resources.

The empirical and theoretical literature bearing on increased active learning time implies that augmenting teacher-student contact is the most direct means. This is primarily achievable by reducing seatwork. With fixed resources, however, this can only be accomplished by increasing, rather than decreasing, group sizes, since a student's seatwork usually occurs when the teacher is meeting with a group to which the student does not belong. Another favored strategy--improving students' independent work habits--would surely enhance the amount of active learning time during seatwork, but at this time there are no proven ways of accomplishing it.

High School Courses Taken

For high school students, it was feasible to look beyond subject-area time allocations or course offerings to actual courses taken from the ninth grade through the end of the twelfth grade. CAP has analyzed courses taken by all high school students and also for a special subgroup, the college-bound seniors.

Table 26 exhibits average coursework of California twelfth graders from the ninth through twelfth grade in several subject areas. Students take more English than any other type of coursework. The average number of years of English taken is 3.8. This is followed by social studies (3.1 years), physical education (3.1 years), mathematics (2.8 years), science (2.1 years) and foreign language (1.5 years). Twenty-nine percent of California seniors report no foreign language coursework in high school.

Table 26

Percent of California High School Seniors Reporting Various Amounts of Coursework, by Subject Area, 1981-82

Subject area	Mean years	Percent of students, by number of years of coursework					
		0	1	2	3	4+	Total
English	3.8	0	1	3	22	74	100
Mathematics	2.8	0	9	30	32	29	100
Science	2.1	1	33	36	20	10	100
Social studies	3.1	1	6	15	41	37	100
Foreign language	1.5	29	21	31	13	6	100
Physical education	3.1	1	2	24	33	40	100

On the other hand, 74 percent report taking four or more years of English. The percent of students reporting similarly high levels of courses taken in other subject areas is substantially lower--physical education (40 percent), social studies (37 percent), mathematics (29 percent), science (10 percent), and foreign language (6 percent).

Only 1 percent of California seniors take four or more years each of English, mathematics, science, and foreign language. Even when the criterion is dropped to three years of science and foreign language but four years of English and mathematics, only 5 1/2 percent of California high school seniors report taking that amount of higher level academic coursework.

Comparing the California data on courses taken to national data is difficult for two reasons. Purely statistical national data on courses taken are based on institutional reports that yield enrollment rates for particular courses but do not link aggregate course registrations to the individuals who produce them (Ostendorf, 1975). Also, since these surveys cover single years, it is impossible to estimate cumulative years of courses taken in terms of the percentage of individuals with zero, one, two, and so on, courses or years of coursework. Survey data on high school students, such as those from the National Longitudinal Study of High School Class of 1972 and High School and Beyond, are potentially comparable data, but in both cases, the data were collected for the last three rather than the last four years of high school.

One approximate comparison, however, is presented in Table 27. Essentially all California high school students take at least one year of mathematics. By assuming that students take their first (or only) math course in ninth grade, CAP derived twelfth grade data that are in line with those of High School and Beyond. It can be seen from Table 27 that California levels of mathematics coursework are similar to, but slightly less than, those across the nation.

Table 27

Percent of Twelfth Graders Reporting Specified Years of Mathematics Coursework Taken in the Last Three Years of High School, 1979-80 and 1981-82

	1979-80*		1981-82**
Years of mathematics	Nation	California	California
0	7.8	9.7	8.6
1	27.3	32.1	30.1
2	33.5	32.6	32.1
3 or more	31.4	25.6	29.2
Total	100.0	100.0	100.0
Median years	1.44	1.25	1.35

*These data are derived from the High School and Beyond survey conducted by the National Center for Education Statistics in 1980.

**These figures have been adjusted to reflect the fact that the High School and Beyond survey inquired only about the final three years of high school and that essentially all California students take at least one mathematics course. Thus, the values have been reduced by one year.

Student enrollment in mathematics and science. Each October for the last two years each California high school teacher has completed a Professional Assignment Information Form as part of the statewide information collection system known as the California Basic Educational Data System (CBEDS). On this form they indicated the number of students in each course they teach.

Tables 28 and 29 present the number and percent of students in grades 9-12 enrolled in mathematics and science courses. It can be seen that the numbers are quite similar from 1980-81 to 1981-82; however, the overall percentage of students enrolled in mathematics courses decreased while there was a slight increase in the percentage of students taking science.

Table 28

Student Enrollment in High School Mathematics Courses*

Course	1980-81		1981-82	
	No. of students	Percent of students**	No. of students	Percent of students**
General Mathematics/Basic	184,138	14.0	167,982	13.2
Consumer Mathematics/Senior	59,339	4.5	49,256	3.9
Remedial Mathematics/Math Labs	177,660	13.5	148,711	11.7
Beginning Algebra	248,433	18.8	239,485	18.8
Intermediate Algebra	54,080	4.1	54,021	4.2
Plane Geometry	119,089	9.0	116,059	9.1
Solid Geometry	3,486	.3	3,759	.3
Trigonometry	14,170	1.1	15,663	1.2
Intermediate Algebra/Trigonometry	33,498	2.5	33,538	2.6
Solid Geometry/Trigonometry	1,257	.1	979	.1
Probability/Statistics	195	.0	235	.0
Modern Algebra	12,862	1.0	8,522	0.7
Computer Programming	12,548	1.0	18,284	1.4
Advanced Placement Mathematics	4,245	.3	4,184	.3
Analytic Geometry/Pre-Calculus	11,358	.9	11,607	.9
Calculus	4,577	.3	6,078	.5
Mathematics, Gifted and Talented	12,683	1.0	11,373	.9
Other Mathematics Course	82,756	6.3	97,393	7.6
TOTAL (General, Consumer and Remedial Mathematics)	421,137	32.0	365,949	28.8
TOTAL (All mathematics courses other than General, Consumer, and Remedial)	615,237	46.7	621,180	48.6
GRAND TOTAL	1,036,374	78.7	987,129	77.4

*Taken from California Basic Educational Data System (CBEDS)

**Based on the total number of students enrolled in high school (grades 9-12): 1,318,713 for 1980-81 and 1,276,368 for 1981-82.

Table 29

Student Enrollment in High School Science Courses*

Course	1980-81 No. of students	1980-81 Percent of students**	1981-82 No. of students	1981-82 Percent of students**
Astronomy	2,202	.2	2,595	.2
Aerospace Education	3,352	.3	3,536	.3
Aviation Education	1,683	.1	1,488	.1
Biology	192,743	14.6	180,768	14.2
Advanced Biology	14,785	1.1	11,932	.9
Botany	1,498	.1	2,041	.2
Zoology	3,051	.2	2,373	.2
Chemistry	61,932	4.7	61,699	4.8
Advanced Chemistry	2,931	.2	3,193	.3
Oceanography	9,045	.7	7,809	.6
Physical Science	49,497	3.8	47,158	3.7
General Science	83,393	6.3	78,441	6.1
Environmental Studies	9,752	.7	8,947	0.7
Physics	25,957	2.0	26,521	2.1
Advanced Physics	1,171	.1	1,174	.1
Anatomy	3,197	.2	3,208	.3
Archeology	447	.0	1,028	.1
Conservation	694	.1	601	.0
Earth Science	22,563	1.7	19,923	1.6
Energy Education	222	.0	410	.0
Geology	2,046	.2	1,446	.1
Life Science	57,869	4.4	63,418	5.0
Meteorology	241	.0	146	.0
Physiology	18,699	1.4	16,459	1.3
Science Projects	493	.0	886	.1
Space Science	293	.0	387	.0
Science, Gifted and Talented	6,945	.5	6,667	.5
Other Science Course	35,856	2.7	36,720	2.9
TOTAL	612,557	46.3	590,974	46.4

*Taken from California Basic Educational Data System (CBEDS)

**Based on the total number of students enrolled in high school (grades 9-12): 1,318,713 for 1980-81 and 1,276,368 for 1981-82.

In mathematics, there was a decrease in the percentage of students taking basic, consumer, and remedial courses, while there was an increase in the percentage of students taking all other mathematics courses. The following mathematics courses had the greatest increases in enrollment: Computer Programming, Calculus, and Other Mathematics Courses. The following courses had the greatest decreases in enrollment: General Mathematics/Basic, Consumer Mathematics/Senior, Remedial Mathematics/Math Labs, and Modern Algebra.

In science, the following courses had the greatest increases in student enrollment: Life Science, and Other Science Courses. The following courses had the greatest decreases in enrollment: Biology, Advanced Biology, and General Science.

It is also interesting to note that although the change in enrollment for Gifted and Talented Mathematics and Science courses from 1980-81 to 1981-82 is minimal, there are approximately twice as many students taking the mathematics course for the gifted.

Coursework of college-bound students. Of special interest is the coursework of college-bound students, who compose about one-fourth of the relevant age population in California as well as in the United States as a whole. A comparison of coursework of California college-bound seniors to that of college-bound seniors nationwide is shown in Table 30. Unquestionably, California college freshmen of 1982 tended to have considerably less coursework than college freshmen nationwide for all core subject areas. In California, 90 percent of 1982 college-bound seniors had four or more years of English as compared to 93 percent in the nation; in California, only 51 percent of this year's college-bound seniors had four or more years of mathematics as compared to 61 percent in the nation; in California, 38 percent of 1982 college-bound seniors had three or more years of foreign language as compared to 39 percent nationwide.

Table 30

Coursework Levels of All Seniors and
College-Bound Seniors, 1982

Years of study	Percent of seniors: California, All seniors*	Percent of seniors: California, College-bound**	Percent of seniors: Nation, College-bound**
English--4 or more years	74	90	93
Mathematics--4 or more years	29	51	61
Foreign language--3 or more years	19	38	39

*CAP 1981-82 survey data.
**SAT student descriptive questionnaire data.

On the whole, the latest year's comparison of coursework in English, mathematics, and foreign language looks more favorable in California than it has in previous years (Table 31).

One comparison is startling: In California, only 41 percent of college-bound seniors report taking two or more years of physical science as compared to 60 percent of college-bound seniors nationwide. If we compare coursework in physical science for the past six years, college-bound seniors in California have not changed; however, nationwide, there has been a substantial increase in the number of college-bound seniors with two or more years of coursework in physical science.

Table 31

Coursework Levels of College-Bound Seniors in California and the Nation, 1973-1982*

	Percent of seniors with course level, by year									
Years of study	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
English 4 or more years										
California	72	69	68	67	68	73	78	81	88	90
National	90	90	89	88	89	90	91	91	92	93
Difference	-18	-21	-21	-21	-21	-17	-13	-10	- 4	- 3
Mathematics 4 or more years										
California	35	35	34	36	37	38	42	45	47	51
National	49	48	49	51	50	53	55	57	59	61
Difference	-14	-13	-15	-15	-13	-15	-13	-12	-12	-10
Foreign language 3 or more years										
California	40	37	34	33	32	32	33	34	34	38
National	44	43	41	39	37	38	37	37	37	39
Difference	- 4	- 6	- 7	- 6	- 5	- 6	- 4	- 3	- 3	- 1
Physical science 2 or more years										
California	31	36	39	40	37	37	39	40	40	41
National	47	48	49	50	54	57	58	58	58	60
Difference	-16	-12	-10	-10	-17	-20	-19	-18	-18	-19

*Data taken from the reports of the Scholastic Aptitude Test (SAT).

If coursework is indicative of achievement, then the lighter course loads of students in California are significant. California college-bound seniors take significantly less coursework in mathematics and science (chemistry, physics, biology) than do college-bound seniors in the United States as a whole (Table 32), even though their coursework in the core academic areas substantially exceeds that of noncollege-bound seniors. But courses taken are of concern beyond these particular comparisons. A major question is whether or not a year and a half of foreign language and two years of science are sufficient for the average high school graduate.

Table 32

Mean Years of Coursework in Academic Subjects for All Twelfth Graders and College-Bound Seniors in California and the Nation, 1982*

	All twelfth graders*	College-bound seniors**	
Subject area	California	California	Nation
English	3.8	4.0	4.0
Mathematics	2.8	3.4	3.6
Science	2.1	2.7	3.2
Social studies	3.1	3.2	3.2
Foreign language	1.5	2.3	2.2

*CAP data.
**SAT data.

Courses taken and future plans. In conjunction with the CAP testing in the fall of 1981, a sample of 5,761 seniors were asked to complete a questionnaire about their high school career and future plans. Students were asked to specify which of the current University of California "A to F" course requirements they had taken. A sample of the question is shown below.

> The University of California requires a series of courses known as "A to F" requirement. These courses are listed below. Even if you do not intend to apply for admission to the University of California, please indicate which of the specific course requirements you have (or will) complete.
>
> 1. History (One year)
> 2. English (Four years)
> 3. Mathematics (Two years, algebra, or higher level)
> 4. Laboratory science (One year must be lab science not "basic")
> 5. Foreign language (Two years)
>
> Any of the following:
>
> 6. Math (advanced) (One added year)
> 7. Foreign language (One added year in same language as 5 or two added years in another language)
> 8. Science (One added year)

It can be seen in Table 33 that the groups differ consistently across the various course requirements. The order of the three public higher education groups is consistent with their entrance requirements. The seniors planning to attend private colleges are very similar to those planning to become part of the California state college and university system. Those planning to work full time take the fewest academic courses while future community college students are only slightly higher in academic course taking than those anticipating military service.

Table 33

Percent of Students Taking University of California Required Courses

Students' Fall Plans	Required Courses							
	History (1 year)	English (4 years)	Mathematics (2 years)	Laboratory Science (1 year)	Foreign Language (2 years)	Advanced Math (1 added year)	Foreign Language (1 added year)	Science (1 added year)
Attend the University of Calfornia	95	98	94	91	88	78	40	71
Attend one of the California State University campuses	91	88	87	82	71	55	25	52
Attend a private college or university	90	86	82	78	69	54	33	53
Attend a community college or other 2 year college	79	70	60	51	39	26	11	31
Work full time	66	50	44	34	20	20	7	24
Join the military	77	54	45	40	25	28	10	32
Other	73	59	55	45	32	27	12	33
TOTAL	77	69	63	55	45	35	16	37

Homework

Students do not learn only while they are in class. They also learn out of school: (a) in settings over which the school has little control--or even knowledge of; and (b) in performance of school-based learning tasks; e.g., homework. Because of its potentiality for increasing learning, homework has recently been given considerable attention.

At the sixth grade level, the assignment of homework varies considerably, by subject area (Table 34). Ninety-five percent of sixth graders report regular homework in mathematics, but only 61 percent do so for writing. And only 66 percent of these students report having had homework in any subject the previous day.

Not reported in Table 34, is the relationship between the students' social backgrounds and the assignment of homework. The highest rates of homework assignment for reading, writing, and mathematics are for students whose parents are employed in unskilled occupations. On the other hand, these same students have the lowest rates of homework assignments--in comparison to other occupational groups--for science and social studies. These findings are strongly consistent with the earlier finding of greater emphasis on reading and less emphasis on science and social studies in schools serving low socioeconomic status communities.

Table 34

Homework Activity Level, by Grade

Grade/subject area	Percent reporting California	Percent reporting Nation
Sixth Grade*		
Usually have homework		
Reading	82	
Writing	61	
Mathematics	95	
Science	63	
Social studies	80	
Yesterday did homework		
Any subject	66	
Twelfth grade**		
Do homework		
Any subject (%)	92	93
Median hours per week	3.0	3.1

*CAP data, 1981-82.
**High School and Beyond, 1979-80.

Aside from direct policy issues about the amounts of time to be spent on homework and the subject-area priorities for this time, central questions arise about who sets these policies. CAP's sixth grade school questionnaire probed this issue (Table 35). The most surprising finding is that these policies are either set at the district level or left to the individual teacher. The school principal--who has emerged in recent research on school effectiveness as the key instructional leader--seemingly plays almost no role in homework policy in California.

Table 35

Origin of Homework Policies, California Elementary Schools, 1981-82

Origin of policy	Percent of schools
Teacher, not school	42.8
School, not district	1.2
District	56.0
Total	100.0

Time and Learning in California Schools

Effects of Subject-Area Time Allocations and Coursework on Student Achievement

Educational research literature is now replete with studies linking instructional time to achievement. The mere fact of such relationships is not, however, a true empirical finding. Logically, if instructional time is adequately defined, it must have a positive relation to learning. That is, if no time is spent, no learning is possible. On the other hand, it is preposterous to allege that students never learn what they are taught. Because teaching and learning always take time, a positive relationship is implied between time devoted to learning and achievement. Thus, failure to find such a relationship or finding of a negative relationship merely indicates inadequacies in the data or the study procedure. For research to be useful for scientific or policy purposes, such inadequacies must be minimized so that estimates of the productivity of instructional time allocations are not substantially biased.

Specifically, as in the CAP study, analyses of the relationship of instructional time allocations to subject areas (sixth grade) and of coursework (high school) to student achievement must reflect differences in amounts of instructional time, in abilities, and in performance histories among students. Generally, sixth graders with histories of poor performance are in schools with greater emphasis on and larger time allocations to basic skills instruction. High school seniors, on the other hand, who take extensive coursework in a specific area are more likely to have higher abilities and histories of high achievement. Thus, analyses of the relationships between instructional time and achievement for sixth graders can be expected to yield underestimates of the effects of instruction, while those for twelfth graders can be expected to yield overestimates, if the relationship of student ability to instructional time allocation or to coursework is overlooked.

Effects at the Sixth Grade Level

This section contains a discussion, and to some degree an interpretation, of the relationship between instructional time and achievement. Table 36 displays the direct relationship of daily instructional time in reading and mathematics to achievement indexes. The indexes* are interpretable as the differences in percent correct achievement on the CAP reading test that result from one additional hour per day of instruction in the particular subject area.

It can be seen that for reading the relationships are negative for all achievement areas cited; that is, as instructional time in reading increases, achievement in reading, writing, and math decreases. The negative reading achievement value (minus 5 1/2 percent per hour of additional instruction) implies that each additional hour of reading instruction is associated with a

---

*The values are the regression coefficients for hours of instruction when these hours are used to explain ("predict") percent of items correct on the CAP instruments.

Table 36

Achievement and Instructional Time in California Schools: Change in Percent Correct Associated with an Additional Hour per Day of Instruction, Sixth Grade, 1981-82

Instructional area	Achievement area		
	Reading	Written language	Mathematics
Reading	-5.5	-3.6	-4.1
Writing/language	+4.8	+4.5	+4.3
Mathematics	+1.0	+1.2	+2.8
Science	+3.7	+2.4	+1.5
Social studies	-6.4	+6.2	+4.9

drop of 5 1/2 points in percent correct on reading items. For mathematics, the relationship is positive. The math achievement value is 2.8, which is interpreted as an increase in percent correct score of 2.8 on math items for each additional hour of daily instruction in math.

Scanning the whole table, we see systematically negative values for additional reading instruction for the three achievement areas. This implies that California elementary schools with high proportions of low achievers allocate substantially more time to reading than do those whose students are high achievers. Because of the substantial impact of out-of-school factors on reading skill and because of heavy public attention on literacy issues, it is not surprising that reading has such a high priority in schools with low performance levels. Clearly, these relationships do not represent the effects of instructional time on achievement, but the reverse--the effects of achievement on instructional time.

The content of the CAP tests reflects the goals of sixth grade instruction statewide. CAP puts forth special effort to maximize this match. The goals of instruction in the sixth grade are similar to and built upon those of earlier grades as well. To the extent that time allocations and instructional priorities in grade six are also strongly reflective of those in the earlier grades, the time-learning relationship is reinforced. If instructional priorities vary substantially over grades, however, this relationship can be seriously weakened.

What is important to realize is the negative relationship of time allocation to reading and achievement in reading. Since reading instruction is a high priority in elementary schools, especially for low-ability students, an important question is which subject areas should receive low time allocations because of the high time allocations to reading instruction.

Effects at the Twelfth Grade Level

As discussed above, the bias in time-achievement relations because of prior performance and ability among twelfth graders is opposite that noted in the sixth grade. The matching of the instructional data and the achievement data is superior, however, in grade twelve. The data on courses taken are for individuals, and they span the full four years of ninth through twelfth grade, thus strengthening and making more appropriate the links between instructional exposure and achievement by students' senior years. Unfortunately, the content tested in twelfth grade does not totally reflect courses taken, especially advanced courses, because the content of the twelfth grade test is consistent with the requirement in the Education Code that the test cover "basic" mathematics.

The relationships between courses taken and achievement for California twelfth graders are displayed in Table 37. These relationships are uniformly positive and considerably more stable than those for the sixth grade. A comparison of the magnitudes of the relationships with those found in sixth grade is problematic, however. Generally, the gain in percent correct score per year of instruction is between 4 and 6 percent. If we assume that a typical yearly course meets an hour per day, then these values are mostly higher than those in the sixth grade. However, three issues obscure this comparison:

1. The sixth grade data refer only to sixth grade instruction, but if the time allocations were stable over all elementary grades--an hour of instruction per day--the total amount of instruction would be several times greater than the instruction accumulated over a single year of high school coursework.

2. The positive relationship between ability and number of courses completed leads to expectations of much higher relationships in twelfth grade than sixth grade.

3. The content of the twelfth grade instrument, being oriented toward quite basic competencies in mathematics, reading, and written expression, does not adequately reflect many of the goals of high school instruction.

Issue (1) would tend to augment estimated sixth grade effects in relation to those in the twelfth grade. Issue (2) augments estimated twelfth grade effects and diminishes those in the sixth grade. Issue (3) diminishes estimated twelfth grade effects in comparison to the sixth grade estimates. Thus, the first and third issues bias the result toward greater sixth grade effects, and the second biases the result toward greater twelfth grade effects.

High School and Beyond test information. The High School and Beyond study allows for comparison of reading and math achievement of California twelfth graders and that of twelfth graders nationwide (Table 38). Obviously, California twelfth graders compare favorably to twelfth graders in general. Given the lower amount of schooling that California students are offered, the data in Table 38 might imply higher productivity of California schools.

Table 37

Achievement Level, by Years of Coursework in Related Areas, Twelfth Grade, CAP Data 1981-82

Years of coursework, by area	Total percent correct	Percent correct, by number of years of coursework					
		0	1	2	3	4	5 or more
Mathematics	67.7						
Math course years		54.9	57.2	62.7	68.3	76.7	75.9
Science course years		57.1	63.0	67.4	73.2	77.1	78.5
Reading	63.2						
English course years		47.3	46.2	51.4	58.5	65.6	67.1
Foreign language course years		57.0	60.7	68.3	70.6	71.6	67.4
Social studies course years		47.1	52.4	60.2	65.5	65.0	65.6
Spelling	69.5						
English course years		55.6	57.8	60.9	65.6	71.2	72.4
Foreign language course years		63.6	67.3	73.6	76.4	77.8	75.0
Social studies course years		57.0	62.5	67.4	71.1	70.6	71.0
Writing	63.2						
English course years		44.3	46.0	50.7	57.7	65.7	67.6
Foreign language course years		55.9	60.1	68.7	72.0	73.8	60.2
Social studies course years		46.5	52.2	60.0	65.7	64.9	65.6

Table 38

Mean Reading and Mathematics Scores of High School Seniors, 1979-80, California and the Nation

Test area	Mean score,* by location		Difference in mean scores
	California	Nation	
Reading	49.9	49.6	0.3
Mathematics			
Part I	50.5	49.6	0.9
Part II	50.1	49.7	0.4

*These are standardized scores. The values have been transformed so that the weighted national mean is 50 and the standard deviation is 10. The reading test consists of five passages, each followed by four multiple choice questions. The mathematics tests cover basic mathematics (Part I) and more advanced high school content (Part II), primarily algebra.

Source: Special analysis of the High School and Beyond base year data by CAP.

Scholastic Aptitude Test (SAT) results. Although California high school seniors in general compare favorably in their reading and mathematics achievement test scores to high school seniors nationwide, concern has been voiced over the recent *SAT* scores, because the California college-bound seniors did not match the new, slightly upward trend of *SAT* scores for twelfth graders nationwide (Table 39). Some clarification on this issue is needed. The *Scholastic Aptitude Test* is taken by about one-third of high school seniors nationwide. Also, about one-third of high school seniors take the *SAT* in California. The math scores of California college-bound seniors on the 1982 *SAT* indicated higher math aptitudes than those of college-bound seniors nationwide. In addition, the verbal aptitudes of California college-bound seniors were not discrepant from the verbal aptitudes of college-bound seniors across the nation.

Table 39

Average *SAT* Scores of College-Bound Seniors, California and the Nation, 1973-1982

	Year									
SAT score	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Verbal										
California	452	450	435	430	427	427	428	424	426	425
Nation	445	444	434	431	429	429	427	424	424	426
Difference	7	6	1	-1	-2	-2	1	0	2	-1
Mathematics										
California	485	484	473	470	470	466	473	472	475	474
Nation	481	480	472	472	470	468	467	466	466	467
Difference	4	4	1	-2	0	-2	6	6	9	7

A comparison of California college-bound seniors' verbal scores to those of college-bound seniors nationwide over the past ten years, however, reveals a much larger test score drop for California test takers. In California, verbal *SAT* scores dropped by 27 points; nationwide, verbal scores dropped 19 points. Ten years ago, California *SAT* test takers had much higher verbal *SAT* scores than *SAT* takers nationally.*

California college-bound seniors also had higher math *SAT* scores than the total national group of college-bound seniors in 1973, but their math *SAT* scores have dropped less dramatically over the past decade than those of college-bound seniors nationwide.

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*If the comparison is extended to 1972, the first year that state-level information became available, the drop is 39 and 26 points for California and the nation, respectively. Coursework data were not available before 1973.

SAT achievement test results. Beyond the verbal and math aptitude tests, many college-bound high school seniors also take achievement tests in various subject-matter areas (Table 40). The achievement test scores show a more revealing picture of school learning, because they are linked more directly to specific course content. However, a comparison of achievement test scores of California college-bound high school seniors to college-bound high school seniors nationwide cannot merely focus on their achievement test scores, because relatively more students in California take one or more of these achievement tests than do similar groups of students nationwide (CA, 32.2 percent; nation, 19.9 percent). The chief reason for this is that one entrance requirement of the University of California is that students take three achievement tests: English composition, mathematics, and a foreign language or social sciences area test. Thus, in contrast to the verbal and math aptitude tests for which the California and national proportions are quite similar, the subject-matter-specific achievement tests are taken by larger proportions of California students than by students nationwide.

Achievement tests are given in English composition and literature, mathematics I and II, biology, chemistry, physics, American history, foreign languages, and several other areas. Most California students take the tests in English composition, mathematics, and American history; the latter fulfills the social science requirement in California. Of special interest are those subject areas in which California students take fewer courses than high school students nationwide: mathematics, biology, chemistry, and physics.

Since a higher proportion of high school seniors in California take the SAT math achievement tests than students nationwide, their average test scores would be expected to be relatively lower than nationally, because the California students should be a less highly selective group than math achievement test takers nationally. Table 41 confirms this expectation. However, if, in some way, the differential selectivity of test takers is adjusted for, then the achievement test scores would be informative with respect to school effectiveness, especially in mathematics and science, where little out-of-school learning occurs.

A gross adjustment for the differential selectivity of achievement test takers can be made by accounting for differences in aptitudes of the achievement test takers. The content of the math section of the SAT is more general than that of the two mathematics achivement tests which cover specific high school course content. Thus, if the SAT math scores are used as an aptitude assessment, the relative differences between aptitude and achievement scores, for California and the nation, would be indicative of relative differences in school learning. Among the college-bound seniors who took the mathematics I achievement test in 1982, CAP found for California students a difference of -10 score points (522-532) and for students nationwide a difference of -7 (545-552) score points. This relative discrepancy of 3 score points between California students and students nationwide might suggest that mathematics instruction in California has lesser outcomes than nationwide. The reason for this finding may be located in the lower course taking in mathematics by California students.

Table 40

Percent of SAT Takers, California and the Nation, and Total and for Selected Achievement Tests, 1982

	Percent SAT takers	
	California	Nation
Percent of single-year age group taking SAT*	25.4	24.3
Percent of seniors taking SAT	33.5	30.6
Percent of SAT takers taking achievement tests:		
Total**	32.2	19.9
English composition	31.2	18.4
Literature	1.2	1.5
Mathematics I	26.0	14.7
Mathematics II	6.3	3.8
Biology	2.0	4.1
Chemistry	1.4	3.5
Physics	0.7	1.6
American history	21.1	5.6
Spanish	5.9	2.6
French	2.7	2.4
German	0.7	0.4
Latin	0.2	0.3

*These are the total number of SAT takers as a percent of the average single-year age group size for individuals fourteen to seventeen years of age.

**Total percent of students taking one or more achievement tests.

Table 41

Percent and Test Scores of SAT Takers, California and the Nation, by Selected Achievement Tests, 1982

Achievement test	Percent of test takers		Achievement test scores		Aptitude test scores			
					Mathematics		Verbal	
	California	Nation	California	Nation	California	Nation	California	Nation
Mathematics I	26.0	14.7	522	545	532	552	479	501
Mathematics II	6.3	4.1	655	661	638	642	533	553
Biology	2.0	4.1	541	548	565	564	524	527
Chemistry	1.4	3.5	590	575	649	619	550	339
Physics	0.7	1.6	614	592	663	642	537	537

In the sciences (biology, chemistry, physics), adjustments occur in the opposite direction than for mathematics. California college-bound seniors who take achievement tests in biology, chemistry, or physics are a much more highly selected group than students taking these tests nationwide. Only 2.0 percent of college-bound seniors take the biology achievement test in California as compared to 4.1 percent nationwide; only 1.4 percent of California college-bound seniors take the achievement test in chemistry as compared to 3.5 percent nationwide; and only 0.7 percent of California college-bound seniors take the achievement test in physics as compared to 1.6 percent nationwide.

The higher selectivity of California college-bound seniors taking the science achievement tests is obvious in their higher mathematical SAT scores. Performing the same adjustments as above for mathematics, CAP found that relative to students' mathematical aptitudes, the achievement of students in physics parallels the achievement of students nationwide. Not so for biology and especially chemistry; in both these areas, students nationwide have considerably higher achievements relative to their mathematical aptitudes than in California. It seems important to link this result to course taking. College-bound seniors in California average one half year less of coursework in science than their counterparts nationwide (see Table 32).

Time and Learning in California Schools

Ways to Increase Student Achievement

Basically, there are four ways to increase student achievement, the first three of which depend on increasing active learning time:

1. Increase the time allocated to instruction.
2. Increase the proportion of allocated instructional time that is actually devoted to instruction.
3. Increase the proportion of time devoted to instruction that students spend actively learning.
4. Reduce the time needed for learning.

Presented below are some suggestions that should be addressed in policy discussions related to improvement of student achievement.

(1) Increase the Time Allocated to Instruction

The time allocated to instruction can be increased in three ways:

- Lengthening the school day and/or school year
- Reallocating instructional time
- Increasing homework assignments

Lengthening the school day and/or school year. Since California students are offered considerably less schooling than students nationwide, lengthening the school day and the school year seems an appropriate strategy for increasing student achievement. As long as procedures are implemented to ensure that the additional time is used to increase the amounts of time devoted to learning activities, this method may be extremely effective. Such procedures, however, would have to be quite different in departmentalized grades--e.g., secondary grades--as opposed to self-contained classrooms. Within departmentalized systems, periods could be added or lengthened. In self-contained classrooms, care would have to be taken to ensure that the additional time is actually used for instruction. The drawback to this strategy is that lengthening the school day or year requires additional resources--either teachers work longer hours or more teachers are needed.

Reallocating instructional time. Another way to increase allocated learning time is through reallocation. In secondary schools, this could occur through elimination of electives or by reinstituting or expanding required courses. These actions result in reallocations from low to high priority learning activities and subject areas. In elementary schools, where individual teachers usually plan their own activities in self-contained classrooms, reallocating instructional time implies either external control or consensus on priority learning areas. All available evidence points to wide and uncoordinated variations in teacher priorities, even within a single elementary school. Thus, influencing such time allocations in elementary schools would require schoolwide discussion and action. One possibility would be to increase the degree of departmentalization in elementary schools, including lowering the grade levels for which it is the mode of instructional organization.

Increasing homework assignments. Increasing homework assignments can be very effective in improving student achievement, and it is the easiest to implement of the three methods described. However, this method should be considered in relation to students' home backgrounds. Where students receive educational support at home, homework can substantially increase their achievements; however, where educational support from the home is lacking, homework assignments are often ineffective. Thus, increased homework without regard to students' home backgrounds would tend to increase achievement for the higher achievers only. One way to increase achievement for all students would be to extend the school day by a homework period.

(2) Increase the Proportion of Allocated Instructional Time That Is Actually Devoted to Instruction

All the time nominally allocated for instructional activities is not actually used for instruction. Some of this loss of time from subject-matter instruction is a result of explicit policy--e.g., fire drills or schoolwide assemblies--and some of it is irremediable--e.g., transitions between one classroom activity and another. However, much lost time can be avoided.

Time accounting studies of elementary school classrooms have found variations of 50 to 90 percent in the portion of total allocated time actually devoted to instruction. Much of the loss results from poor management of student activities: excessive transition time between activities, poorly handled recesses and breaks, pullout activities that are disruptive or that increase transition time, and subgroup and seatwork activities that take too long to establish. Also, in many classrooms, schedules are not met or activities involving more than one teacher are poorly coordinated. All these problems result in losses of precious instructional time in elementary schools.

Secondary schools, because of the period structure and departmentalized organization, are less prone to losses of this type, but issues do arise about the length of period transitions and how related rules are enforced. More effort devoted to identification of such problems and formulation of appropriate school policies or in-service training efforts would be worthwhile.

The following steps should be considered:

- Review pullout programs to determine the difference between allocated instructional time and time actually devoted to instruction.

- Increase teachers' classroom management skills; staff development and in-service training should focus on management skills. Teacher training institutions need to put more emphasis on developing such skills.
- Evaluate school schedules (e.g., length of period, recess, lunch) to determine how much time scheduled for instruction is lost.

(3) Increase the Proportion of Time Devoted to Instruction That Students Spend Actively Learning

The clearest message from the research on active learning time ("time-on-task," "engaged time," "academic learning time") is that active learning is fostered by teacher-student contact and interchange. Unsupervised learning activities have uniformly lower levels of active learning time. Small-group instruction and--to an even greater extent--tutorial instruction increase students' active learning time. This increase is most pronounced among students who have low achievement or motivation levels, such as educationally disadvantaged students.

The problem with routinely implementing changes based on the above findings is one of resources. In many classrooms, lower teacher-student ratios could be achieved by reducing the size of supervised instructional groups, thereby increasing teacher-student contact time. In self-contained classrooms, without additional resources, there is a trade-off: When some students are tutored or taught in small groups, others are necessarily unsupervised. Thus, the critical issue--with resources being constant--is the trade-off between (a) large-group instruction accompanied by little unsupervised work; and (b) small-group/tutored instruction accompanied by considerable amounts of unsupervised, student-managed activity. The best evidence available is that reducing unsupervised time, even at the cost of increasing the total amount of large-group instruction, is appropriate, especially with students who have low levels of learning motivation and self-discipline and who are poorly prepared for academic work.

It is recommended that school personnel:

- Review the grouping strategies that are routinely used in elementary schools and that are encouraged by textbooks and workbooks. Minimizing subgrouping, and thereby unsupervised seatwork, should be a primary goal.
- Evaluate the use of aides in classrooms; using qualified aides is an effective way to increase direct instruction for students.

(4) Reduce the Time Needed for Learning

Instruction can be made more effective in many ways, which in turn will reduce the time needed for learning. Two ways deserve attention:

1. Increasing the clarity and communicability of task-related instructions provided by the teacher or in text materials;

2. Increasing the capabilities of teachers to diagnose students' prior learning, to sequence the instructional tasks, and to keep the students working at a satisfying but challenging pace.

First, clear explanations and communication are the keys to decreasing the time students need to master or complete a task. This is especially true for students from low socioeconomic backgrounds. These students are especially affected by inappropriate and unclear explanations and verbal communications, whether they emanate from teachers, textbooks, or other instructional materials. The more capable students and those from higher socioeconomic backgrounds can, by themselves, "fill in" or substitute for incomplete or insufficiently communicated instruction.

Second, teachers need to consider students' abilities and prior learning in arranging learning tasks for them and estimating the time needed for learning. The time needed for learning is unnecessarily increased if teachers incorrectly assume specific prior learning for a task or if they allocate time to tasks that students have already mastered.

Staff development efforts should address these issues. Also, textbooks and workbooks should be more carefully screened and pretested with particular types of students. Teachers should be taught to use diagnostic instruments more extensively for assessing students' prior learnings. At best, improving teachers' ability to communicate is difficult, because communication skills are learned over long periods early in one's life. Improved teacher recruitment and selection are the only long-term solutions certain to bring about significant improvement in communication skills.

It is recommended that school personnel:

- Evaluate textbooks and workbooks for clarity of instruction;

- Make greater use of diagnosis to ensure improved pacing of learning and challenge of students.

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APPENDIX

CHARACTERISTICS OF EXEMPLARY SCHOOLS*

Exemplary schools have principals who:

- Create a sense of direction for the school
- Execute their designated leadership role
- Foster academic expectations
- Recruit their own staff
- Have more advanced training
- Tend to have an education as elementary school teachers
- Have particular competence in one area of the curriculum, such as reading or mathematics

Exemplary schools are staffed by teachers who:

- Demonstrate proficiency in verbal skills
- Have substantial educational background
- Are experienced
- Have achieved employment status; that is, job satisfaction and salary level
- Have high expectations for the pupils
- Have better control of classes with less overt effort
- Are supported in their expectations by the principal and the parents
- Tend to use grouping procedures that emphasize small instructional groups for reading and mathematics but use the whole-group approach for social studies, science, and health

Exemplary schools are composed of students who:

- Possess a sense of control of their own destiny
- Believe that how well they do in school depends more upon hard work than upon luck
- Understand from the principal, the teachers, and their parents that all three groups have high expectations for their achievement

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*Taken from Austin (1981)

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Exemplary schools are schools where parents:

- Are an integral part of the educational process
- Are involved in decisions being made about their children's future
- Feel that they are real partners with school administrators and educators in educating their children

Exemplary schools have high expectations:

- For all students regardless of socioeconomic background variables, race, or handicap
- For all teachers regardless of their background, training, or former experience
- For all aides regardless of their background and training
- For the principal and for other administrators of the school
- For all staff people associated with the school, including office staff, kitchen staff, janitorial staff, and others.

Organizationally, exemplary schools:

- Tend to have a high degree of articulation, particularly in reading and mathematics
- Base inservice staff development programs on needs identified by the school staff, not by the central office
- Give very high priority to time in the school day for instructional activities

Instructional practices in exemplary schools:

- Require that academic objectives be clearly identified and stated
- Tend to use small-group and individualized instruction for mathematics and reading; whole-group instruction for other curriculum areas
- Encourage direct instruction by the teacher
- Consider prior learning and learning styles of the students

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VIII. Computers in California Elementary Schools

Synopsis of Findings

- Twenty-nine percent of the elementary schools in California have a terminal or microcomputer.
- One-half of the elementary schools with a terminal or microcomputer indicated that students spent less than 15 minutes daily at a terminal.
- Eighty-three percent of schools with computers use them for computer-assisted instruction.
- Content areas most often studied with the computer were mathematics, vocabulary/spelling, language, and reading.
- Eighteen percent of sixth grade students indicated that they had a computer at home.
- Forty-five percent of the students indicated that they had a video game at home.
- Twenty-four percent of the students indicated that they played electronic games away from home several times a week.
- Seventy-eight percent of the students indicated that they never have used a computer in school.

A statewide survey of computer use in schools and of student experiences with computers was conducted during the spring, 1982, administration of the California Assessment Program's Survey of Basic Skills: Grade 6. The primary goal of the computer survey was to obtain preliminary data on student and school access to computer equipment and the educational applications of this equipment. A further goal was to relate achievement and socioeconomic status to different school applications and different degrees of student experience. Public school use of computers has been of recent interest. The results of a survey conducted for the National Center for Education Statistics in April of 1982 showed that the number of personal computers used in schools for instructional purposes tripled between the fall of 1980 and the spring of 1982. Thirty-five percent of the public schools nationwide had computers available for instruction in the 1981-1982 school year. The results reported here are a more detailed examination of computer use in California.

Study Design

Survey Questions. The survey of school principals addressed the issues of access to equipment, staff development, and types of use. The questions were:

1. Do you have a computer terminal (or microcomputer such as APPLE or TRS80) in your school? (yes, no) The remaining questions were answered by those who said yes.

2. How many computer terminals or microcomputers are there in your school? (1, 2, 3-5, 6-10, 11-20, more than 20)

3. Where are your terminals located? (in the computer media room, in individual classrooms, other)

4. Indicate in which of the following ways the computer is used in your school.

    a. Computer assisted instruction - involving direct student and machine interaction

    b. Computer managed instruction - test scoring, maintaining pupil progress records, etc.

    c. Administration - scheduling, etc.

    d. Computer literacy and education - for students or teachers

5. What proportion of your teachers have participated in any workshops or other staff development oppportunities focusing on computer literacy or the role of computers in education? (all, most, some, a few, none).

6. Indicate the subject areas which are studied on the computer.

    a. Reading

    b. Vocabulary/spelling

    c. Language

    d. Science

    e. Math drill

    f. Mathematics problem solving

    g. Music

    h. Foreign language

    i. Health

    j. Simulation and games

    k. Programming

    l. Creative applications

    m. Other

7. About how many sixth grade students participate in instructional programs using computers? (all students, about three-fourths, about one-half, about one-fourth, less than one-fourth)

8. On a typical day, how much time does a sixth grade student spend at the terminal? (less than 15 minutes, about 15 minutes, about 1/2 hour, about 1 hour, more than 1 hour)

9. During a typical week, how many times does a sixth-grade student use a terminal? (once, twice, three times, four times, five times or more)

The student survey addressed the availability and use of equipment at home and away from home. The questions were:

1. Do you have a computer at home? (yes, no)

2. How often do you use a computer in school? (never, once a month, once a week, several times a week, every day)

3. Do you have an electronic TV game (like Atari) at home? (yes, no)

4. How often do you play electronic games (like Atari) away from home? (never, once a month, once a week, several times a week, every day, several times a day)

School Sample. A one-fourth systematic sample of schools was drawn for use with the survey of school principals. The school principal, or other person certifying correct administration of the CAP test, responded to the survey. The data were received from all 987 schools that received this survey.

Student Sample. Sixth graders were systematically selected to respond to the student survey. Questions were included on several of the 40 unique forms of the sixth grade test, which were spiraled for distribution to ensure random assignment of forms to students and equal numbers of students taking each form. The two questions, "Do you have a computer at home?," and "Do you have an electronic TV game (like Atari) at home?," were included together on three forms and responded to by 21,908 students. The question, "How often do you use a computer in school?," was included on three different forms and responded to by 21,880 students. Finally, the question, "How often do you play electronic games (like Atari) away from home?," was placed on four other forms and was responded to by 29,311 students. Less than 3 percent nonresponse was obtained for all questions.

Analyses. The analysis of the survey of school principals commenced with the regression of mean school percent correct achievement on a measure of socioeconomic status. The measure of socioeconomic status was based on teacher ratings of parent occupation. Occupational categories were professional, semiprofessional, skilled, and unskilled. Separate regressions were performed for reading, written language, and mathematics. Residuals were calculated for each content area. These were scaled to have a mean of 50 and a standard deviation of 15 for convenience in displaying the results. School achievement residual scores and the measure of socioeconomic status were broken down on the basis of responses to the questions. Student percent correct scores were broken down on the basis of responses to questions and on student socioeconomic status.

Computers in California Elementary Schools

Results

Access to Equipment

The results for the question, "Do you have a computer terminal (or microcomputer such as APPLE or TRS80) in your school?," are shown in Table 42. Twenty-nine percent of the sample schools indicated that they possessed this equipment. These schools tended to have higher average student socioeconomic status. The remaining questions in the survey were responded to by the 287 schools with computer equipment.

The results for the question, "How many computer terminals or microcomputers are there in your school?," are shown in Table 43. Forty-one percent indicated one, 16 percent indicated two, 30 percent indicated three to five, 9 percent indicated six to ten, 4 percent indicated 11 to 20, and 1 percent indicated more than 20.

The results for the question, "Where are your terminals located?," are shown in Table 44. The equipment was located in the computer media room for 36 percent, in classrooms for 46 percent, and elsewhere for 28 percent of the schools. These percents sum to more than 100 because schools could indicate more than one location. Schools with classroom locations tended to have higher average student socioeconomic status.

Applications in education

The results for the question, "On a typical day, how much time does a sixth grade student spend at the terminal?," are shown in Figure 34. The percents corresponding to each option were as follows: less than 15 minutes, 48 percent; about 15 minutes, 28 percent; about one half hour, 22 percent; and about one hour, 2 percent. No schools indicated that their students spent over one hour per day on the computer.

Responses to the item "Indicate in which of the following ways the computer is used in your school" are shown in Table 45. The equipment was used for computer-assisted instruction by 83 percent of the schools, for computer-managed instruction by 19 percent of the schools, for administration by 14 percent of the schools, and for computer literacy education by 51 percent of the schools. Again, percents sum to over 100 because more than one use could be marked by a school.

The responses to the question, "Which subjects are studied on the computer?" are shown in Table 46. Those content areas with the highest levels of use were math drill, 61 percent; math problem solving 49 percent; simulation and games, 43 percent; vocabulary/spelling, 38 percent; programming, 36 percent; language 34 percent; and reading, 33 percent. Relatively higher achievement is associated with programming and with simulation and games, contrasting with roughly average achievement associated with reading, vocabularly/spelling, and language applications. Other content areas were associated with high achievement, although they were not indicated as frequently as those already listed. These other content areas were science, 13 percent;

and creative applications, 22 percent. Generally, higher socioeconomic status was associated with higher achievement.

The results for the question, "What proportion of your teachers have participated in any workshops or staff development?" are shown in Figure 35. Although 287 schools said they had computer equipment, 331 schools responded to this question. The percents responding to each option were as follows: all, 15 percent; most, 14 percent; some, 22 percent; a few, 40 percent; and none, 8 percent. Achievement tended to be higher in those schools with more staff development. Mathematics achievement is higher for those schools responding "all" than for those responding "most." Average socioeconomic status was highest for those schools that indicated that most of their teachers had staff development training and was lowest for those schools that indicated a few teachers had such training.

Student exposure

The results for the question, "Do you have a computer at home?," are displayed in Table 47. Eighteen percent of the students said yes, which included a higher proportion of boys than girls. Larger percentages of students of higher socioeconomic status than lower socioeconomic status reported having a computer at home. Achievement was nearly the same for both groups of students.

The results for the question, "Do you have an electronic TV game (like Atari) at home?," are shown in Table 48. Forty-five percent of the students said yes. Larger proportions of boys than girls reported having such games. More than half the students in each of the two upper socioeconomic status groups said yes, compared to less than half of the students from the lower two socioeconomic status groups. Achievement scores were higher for those who said yes than for those who said no: in reading, 70.4 percent correct compared to 65.4 percent correct; in written language, 74.1 percent compared to 70.7 percent correct; and in mathematics, 64.7 percent correct compared to 59.3.

A plot of achievement results broken down by socioeconomic status is shown in Figure 36. Total percent correct achievement is plotted. The largest difference in achievement is shown for students in the "unskilled" category. Students from the "professional" category had the smallest difference in achievement. It is very unlikely that the presence of a home video game is responsible for higher achievement. A plausible alternative is that access to such games is part of a home environment where parents desire to provide intellectually stimulating activities for their children. Such parental influence, making itself felt in many ways, might well be the cause of higher achievement.

The results for the question, "How often do you use a computer in school?," are displayed in Table 49. The percents of students responding to each option were as follows: never, 78 percent; once a month, 7 percent; once a week, 6 percent; several times a week, 4 percent; and everyday, 2 percent. Roughly equivalent proportions of boys and girls indicated each response. Slightly smaller percentages of students in the "professional" category reported never using a computer in school compared to students in other socioeconomic status groups. Higher proportions of students in the two upper socioeconomic status groups, compared to those in the two lower groups, reported using a computer once a month or once a week. For more frequent use, the percentages of students from all socioeconomic groups are roughly the same.

The results for the question, "How often do you play electronic games away from home?," are shown in Table 50. The percents of students reponding to each option were as follows: never, 18 percent; once a month, 22 percent; once a week, 21 percent; several times a week, 24 percent; every day, 7 percent; several times a day, 6 percent. Higher percentages of boys reported playing more frequently, and higher proportions of girls reported playing less frequently. A plot of achievement results broken down by socioeconomic status is shown in Figure 37. Higher frequencies of playing electronic games away from home are associated with lower achievement for all socioeconomic status groups. Students who report never playing such games have slightly lower achievement than those who report playing once a month. No claim is made that playing video games away from home is responsible for lower achievement. A plausible alternative is that a lack of positive influences in the home environment could both discourage academic success and encourage playing away from home.

Table 42

Results for the Question, "Do You Have a Computer Terminal (or microcomputer such as APPLE or TRS80) in Your School?"

Response	Count	Percent	Socioeconomic Status
Yes	287	29	2.20
No	700	71	1.99

Table 43

Results for Responses to the Question, "How Many Computer Terminals or Microcomputers are There in Your School?"

Response	Count	Percent	Socioeconomic Status
1	118	41	2.18
2	45	16	2.16
3-5	87	30	2.21
6-10	25	9	2.28
11-20	12	4	2.21
Greater than 20	3	1	1.81

Table 44

Results for Responses to the Question, "Where Are Your Terminals Located?"

Response	Count	Percent	Socioeconomic Status
Computer media room	104	36	2.19
Classrooms	133	46	2.23
Other	79	28	2.15

Table 45

Results for the Item, "Indicate in Which of the Following Ways the Computer is Used in Your School?"

Response	Count	Percent	Socioeconomic Status
Computer-assisted instruction	239	83	2.19
Computer-managed instruction	55	19	2.06
Administration	40	14	2.15
Computer literacy	146	51	2.32

Table 46

Results for Responses to the Question, "Which Subjects Are Studied on the Computer?"

Response	Count	Percent	Reading	Writing	Math	Socioeconomic Status
Reading	97	33	48.71	48.44	48.26	2.08
Vocabulary spelling	108	38	49.70	49.78	49.56	2.12
Language	98	34	51.31	51.38	52.13	2.13
Science	36	13	55.31	55.25	56.67	2.63
Math drill	174	61	51.52	50.80	51.51	2.16
Math problem solving	128	49	52.61	52.53	52.94	2.18
Music	5	1	55.40	57.68	58.16	2.38
Foreign language	4	1	54.12	54.23	55.91	2.00
Health	2	1	58.78	60.35	56.62	2.04
Simulation and games	124	43	54.42	53.52	54.37	2.28
Programming	103	36	55.04	53.91	55.42	2.35
Creative applications	62	22	55.16	53.09	54.71	2.40

Table 47

Results for the Question, "Do You Have a Computer at Home?"

	Percent of Sample							Percent correct score		
Response	Overall	Boys	Girls	Professional	Semi-Professional	Skilled	Unskilled	Reading	Written Language	Math
Yes	18	21	15	21	19	18	14	67.5	71.8	61.6
No	79	77	82	77	79	79	84	67.7	72.4	61.8
No response	3	2	3	2	2	3	2	60.3	64.9	54.1

Table 48

Results for the Question, "Do You Have an Electronic TV Game (like Atari) at Home?"

	Percent of Sample							Percent correct score		
Response	Overall	Boys	Girls	Professional	Semi-Professional	Skilled	Unskilled	Reading	Written Language	Math
Yes	45	53	37	56	52	46	29	70.4	74.1	64.7
No	53	45	61	43	46	52	68	65.4	70.7	59.3
No response	2	2	2	1	2	2	3	57.8	62.8	51.7

Table 49

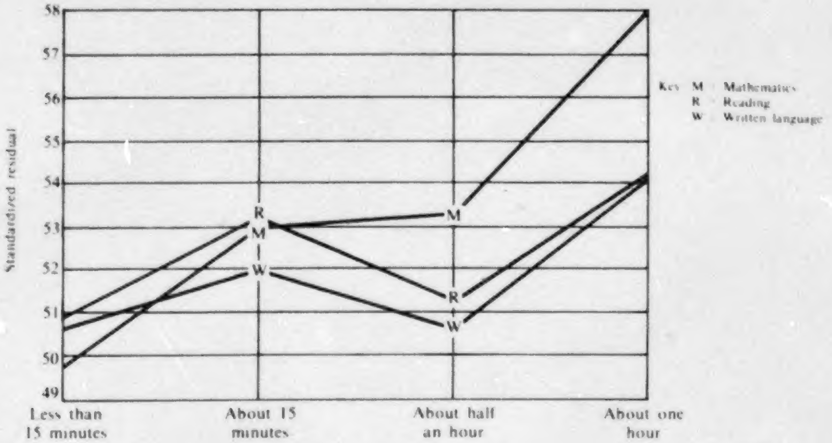
Results for the Question, "How Often Do You Use a Computer in School?"

Response	Percent of Sample							Percent correct score		
	Overall	Boys	Girls	Professional	Semi-Professional	Skilled	Unskilled	Reading	Written Language	Math
Never	78	77	80	74	79	80	80	71.5	74.1	62.4
Once a month	7	7	7	10	9	6	6	74.7	75.9	65.3
Once a week	6	6	6	7	6	5	5	72.2	74.7	64.8
Several times a week	4	5	3	5	3	4	5	69.6	72.4	62.2
Every day	2	2	1	1	1	2	2	64.7	65.6	55.4
No response	3	3	3	3	2	3	2	65.7	67.6	57.4

Table 50

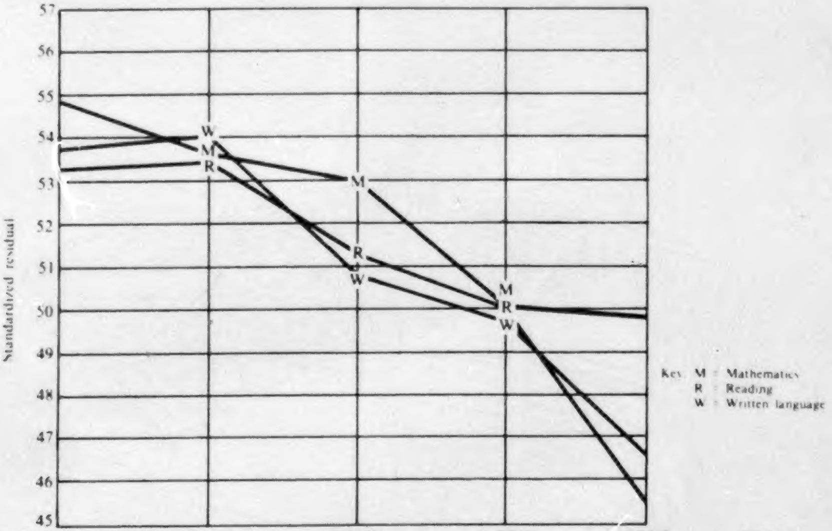
Results for the Question, "How Often do You Play Electronic Games Away From Home?"

Response	Percent of Sample							Percent correct score		
	Overall	Boys	Girls	Professional	Semi-Professional	Skilled	Unskilled	Reading	Written Language	Math
Never	18	11	25	14	14	18	25	67.7	71.3	58.8
Once a month	22	19	25	29	25	21	16	77.0	78.9	68.4
Once a week	21	22	21	24	23	21	18	73.3	75.6	65.0
Several times a week	24	28	19	23	25	25	23	72.1	74.9	63.2
Every day	7	10	4	4	6	7	8	63.0	68.3	55.0
Several Times a day	6	8	4	5	5	6	7	65.7	69.5	56.6
No response	2	2	2	1	2	2	3	61.0	65.4	52.7



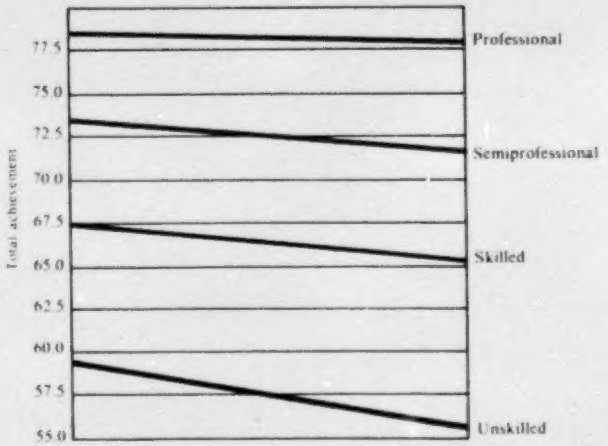
	Less than 15 minutes	About 15 minutes	About half an hour	About one hour	TOTAL
Reading	51.09	53.25	51.13	54.15	–
Written language	50.74	51.99	50.54	54.25	–
Math	49.87	52.92	53.29	58.12	–
SES	2.24	2.21	2.13	2.30	–
Count	106	61	49	5	221
Percent	48	28	22	2	100

Fig. 34. Responses to question, "On a typical day, how much time does a sixth grade student spend at the terminal?" by subject area



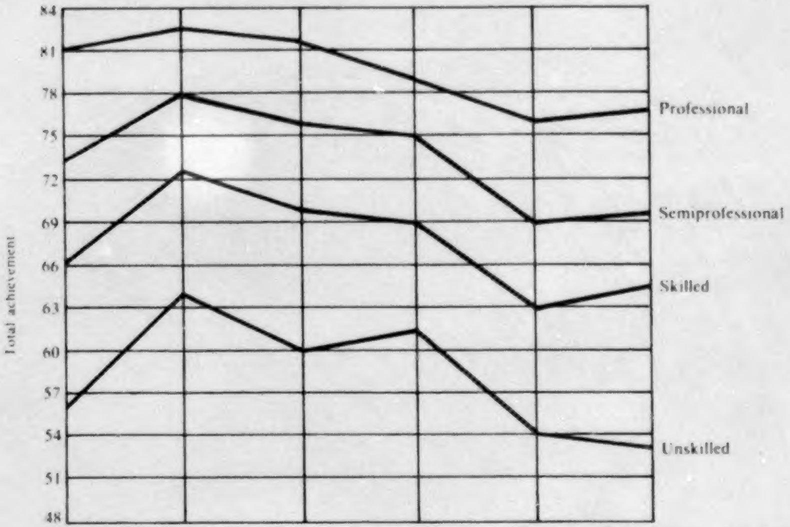
	ALL	MOST	SOME	A FEW	NONE	TOTAL
Reading	53.18	53.57	51.35	50.07	45.55	-
Written language	53.73	54.02	50.86	49.85	46.46	-
Math	54.71	53.49	52.04	50.02	50.10	-
SES	2.26	2.31	2.20	2.11	2.19	-
Count	51	47	74	132	27	331
Percent	15	14	22	40	8	100

Fig. 35. Responses to question, "What proportion of your teachers have participated in any workshops or staff development?" by subject area



	Yes	No	No response	TOTAL	Percent
Professional	2,004	1,556	48	3,608	16
Semiprofessional	2,168	1,937	79	4,184	19
Skilled	3,652	4,199	159	8,010	37
Unskilled	1,192	2,738	114	4,044	18
Unknown	503	807	50	1,360	6
No response	277	374	51	702	3
Total	45	53	2		

Fig. 36. Student responses to question, "Do you have an electronic TV game at home?" by total achievement and parents' socioeconomic status



	Never	Once a month	Once a week	Several times a week	Every day	Several times a day	No response	TOTAL	Percent
Professional	692	1,399	1,124	1,090	198	219	59	4,781	16
Semiprofessional	828	1,455	1,347	1,464	335	272	86	5,787	20
Skilled	1,878	2,287	2,290	2,642	793	619	189	10,698	36
Unskilled	1,331	863	981	1,214	442	358	141	5,330	18
Unknown	405	281	329	396	149	116	75	1,751	6
No response	183	195	204	191	66	58	67	964	3
Total	5,317	6,480	6,275	6,997	1,983	1,642	617	29,311	
Percent	18	22	21	24	7	6	2		

Fig. 37. Student responses to question, "How often do you play electronic games away from home?" by total achievement and parents' socioeconomic status

Appendix A
Assessment Advisory Committees

Listed below are the members of the Reading Assessment Advisory Committee, English Language Assessment Advisory Committee, and the Mathematics Assessment Advisory Committee, who were instrumental in the review and analysis of the 1981-82 findings.

Reading Assessment Advisory Committee

Espy Acuna, Central Union High School District
Cathy Beedle, San Marino Unified School District
Sandy Biren, San Juan Unified School District
Ashley Bishop, California State University, Fullerton
Lois Braun, Santa Monica-Malibu Unified School District
Jacqueline Chaparro, Office of the San Diego County Superintendent of Schools
Pat Endsley, Berkeley Unified School District
Harry Ford, Covina Valley Unified School District
Dorothy Grier, Chino Unified School District
Ruth Hartley, California State University, Sacramento
Cecilia Hill, Los Angeles Unified School District
Jacqueline Hodge, West Fresno Elementary School District
Jack Jones, California Polytechnic State University, San Luis Obispo
Joyce Krutop, National Elementary School District
Heath Lowry, University of the Pacific
Robert Lowry, Alum Rock Elementary School District
John Malkasian, Sacramento City Unified School District
Beverly Maple, San Juan Unified School District
Donavan Merck, State Department of Education
Janice Meyer, Office of the Santa Barbara County Superintendent of Schools
Deborah Osen Hancock, California State College, Bakersfield
Alpha Quincy, Mt. Diablo Unified School District
Grayce Ransom, University of Southern California
Marie Santos, Denair Unified School District
Marian Schilling, Office of the Los Angeles County Superintendent of Schools
Pam Shilling, Corona-Norco Unified School District
Alice Scofield, San Jose State University
Joellyn Taylor, Far West Regional Laboratory
Myrna Tsukamoto, San Francisco Unified School District
Barbara Valdez, North Sacramento Elementary School District
John Walters, Office of the San Diego County Superintendent of Schools
Beth Breneman, State Department of Education Consultant to the Committee

English Language Assessment Advisory Committee

Diana Adams, Lakeside Unified School District
Sheila Anchondo, San Bernardino City Unified School District
Robert Beck, John Swett Unified School District
Stephen Black, Oakland Unified School District
Judy Carlton, Hacienda La Puente Unified School District
Muriel Dillard, Office of the Kern County Superintendent of Schools
Bonnie Garner, El Monte Elementary School District
Kent Gill, Davis Joint Unified School District
Richard Giovannoli, Biggs Unified School District
Bernard Goodmanson, Los Angeles Unified School District
Julia Cottesman, Office of the Los Angeles County Superintendent of Schools
Jim Gray, University of California, Berkeley
Louise Grindstaff, California State University, Northridge
Wayne Harsh, University of California, Davis
Everett I. Jones, University of California, Los Angeles
Helen Lodge, California State University, Northridge
Marguerite May, Los Angeles Unified School District
Joanna McKenzie, California State University, Northridge
Pat Moore-Howard, Sacramento City Unified School District
Jim Musante, Moraga Elementary School District
George Nemetz, State Department of Education
Rocky Ortega, Oxnard Union High School District
Dale Oscarson, Palo Alto City Unified School District
Alice Scofield, San Jose State University
Linda Short, Los Angeles Unified School District
Barbara Tomlinson, University of California, San Diego
Ross Winterowd, University of Southern California
Bill Wise, San Juan Unified School District
Joanne Yee, Gold Oak Union Elementary School District
Beth Breneman, State Department of Education Consultant to the Committee

Mathematics Assessment Advisory Committee

Charles Allen, Los Angeles Unified School District
Joan Akers, Santee Elementary School District
Marguerite Brydegaard, San Diego State University
Joe Cooney, Office of the San Mateo County Superintendent of Schools
Clyde Corcoran, Whittier Union High School District
Richard Dean, California Institute of Technology
Sister Rose Eleanor Ehret, Holy Names College
Lyle Fisher, Tamalpais Union High School District
Ruth Hadley, Lompoc Unified School District
Joseph Hoffmann, State Department of Education
Thomas Lester, San Juan Unified School District
Gail Lowe, Conejo Valley Unified School District
Sandy Marshall, University of California, Santa Barbara
Vance Mills, San Diego City Unified School District
Susan A. Ostergard, University of California, Davis

Holland Payne, Sacramento City Unified School District
Henry Palmer, Office of the Los Angeles County Superintendent of Schools
Ruth Riley, Fresno Unified School District
Linda Silvey, Los Angeles Unified School District
Jean Stenmark, Oakland Unified School District
Harold Taylor, San Mateo Union High School District
Shirley Trembley, Bakersfield College
Tej Pandey, State Department of Education Consultant to the Committee

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